AN INVESTIGATION OF THE BENDER-GESTALT
AS A SCREENING TECHNIQUE FOR PSYCHIATRIC
DISORDERS IN CHILDREN

by

MARJORIE ELLEN LUDLOW ROWE

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Abstract

The present study utilized three groups of children: 200 normals, 60 emotionally disturbed and 39 suffering some degree of cerebral dysfunction. Their ages ranged from 10-0 through 14-11 and their IQs from 76 to 126.

Each child was administered individually the Spiral Aftereffect Test, the writer's version of the Trail Making Test and the Bender-Gestalt Test. The Bender-Gestalt protocols were then scored by the Pascal-Suttell method. Although it was found that each of the three tests discriminated between the groups at the .1% level of confidence, they were of little value for individual prediction purposes.

Two brief screening scales, Scale A (Emotional Disturbance) and Scale B (Neurological Referral) were then constructed from scorable deviations on the Bender-Gestalt Test and from parts of the Spiral Aftereffect and Trail Making Tests. When these scales were applied to the test data, they were also able to discriminate between the groups at the .1% level. The scales improved on the Pascal-Suttell method in making individual discriminations in that they misclassified fewer subjects in both experimental groups than the Pascal-Suttell method.
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Chapter 1.
INTRODUCTION.

In selecting the three tests which comprise the battery being used in the present study, the writer's primary concerns, other than validation, were as follows: 1) that the tests should be as free as possible from emotionally charged stimuli, 2) that the tests should be brief and of high enough interest value to hold the child's attention for the approximately 20-minute period necessary to complete the battery, 3) that the tests should demand the minimum of verbalization, 4) that the ability to cope successfully with the tests should lie within the capacities of a normal child from ten to fifteen years-of-age, and 5) that failure or poor performance should be made as indiscernible as possible to the child.

The Bender Visual Motor Gestalt Test not only fulfills these requirements, but, in addition, offers in the form of the protocol, a permanent, objective record produced by the child himself, which automatically avoids the slipping of the Examiner's own needs into the protocol, which can occasionally happen in attempts to record verbatim a child's verbalizations during intelligence or projective testing.

The Bender-Gestalt is the primary focal point of the battery in the present research, due to the writer's interest
of long duration, as well as scepticism of the diagnostic capabilities claimed for it. The Spiral Aftereffect Test and the Trail-Making Test, both of which fulfill to a lesser degree the criteria set up for the battery, will be utilized as adjuncts to the Bender-Gestalt.

The broad question which this research is attempting partially to answer is this: given three groups of children who are not mentally retarded and whose chronological ages range from 10 to 15 years, can the Bender-Gestalt, as scored by the Pascal-Suttell method, discriminate between the protocols of normal children, children who are emotionally disturbed, and children suffering some degree of cerebral dysfunction? If the following three tests are used, the Bender-Gestalt, the Spiral Aftereffect Test and the Trail-Making Test, can any single test differentiate between the three groups better than the other two? Or, can any combination of factors in the battery make the discrimination at a level significantly high to warrant the use of the battery as a screening technique?

The groups used in this study are composed of children whose disturbances have been considered sufficiently severe by the attending psychiatrist to recommend special class placement or residential treatment. In the psychiatric group, however, no child was psychotic at the time of testing, while in the group suffering cerebral dysfunction,
no child suffered gross motor impairment. Thus, the groups closely resemble those children who present the more common type of diagnostic problem with which the clinical psychologist is confronted in his daily work. It must be recognized, however, that the subjects' responses possibly present a greater challenge to the discriminatory capacity of these tests, than would occur if more severely disturbed, less intelligent, or more impaired children were used.

Since the inception of this study in late 1959, two important papers have appeared on the extent to which the Bender-Gestalt is used in the United States. Unfortunately, similar information is not available for the United Kingdom. From discussions, however, with psychologists working in hospitals, child guidance clinics, and residential treatment centres, it is the impression of the writer that although the field is generally well acquainted with the test, the Bender-Gestalt has received neither the widespread acceptance nor the attention, in the form of research, which it has provoked in the United States.

Sundburg (106), in a questionnaire concerning testing practices and the usage of specific tests in the United States, obtained responses from 24 Veterans' Administration Hospitals, 39 state mental hospitals, 13 institutions for mental defectives, 16 adult outpatient clinics, 37 child guidance clinics, 23 counselling centres and 16 university
training clinics. Although the total response was approximately 10% of all agencies and institutions, it may be considered a conservative estimate, since it did not include industry, the military, private clinics, or private practices. Sundburg found that in his Rank on Frequent Usage, the Bender-Gestalt ranked third of all tests given in the total population sample, falling below only the Rorschach and the Draw-A-Person in popularity. But, as Sundburg stated, "...popularity does not mean validity." ¹

In a follow-up study, Schulberg and Tolor (91) investigated the use of the Bender-Gestalt in clinical practice, in an attempt to determine how the test is employed and in what esteem it is held by clinicians. Again the questionnaire method was used, with responses being received from 176 clinical psychologists, 94% of whom had been doing diagnostic evaluations for a minimum of five years. Of these, 85% make use of the Bender-Gestalt in testing adults, and 68% use it with children. The case loads of the respondents were not stated.

The Bender-Gestalt was found to be most commonly used in evaluating organicity, with its use in determining psychoses or intellectual retardation less common. Almost half of the clinicians questioned expressed "little confidence" in the use of the test to elucidate personality dynamics. A provocative finding is that the most common method of

¹ p.83.
interpreting the Bender-Gestalt is in the subjective or intuitive manner, with only 5% feeling that an objective scoring system alone is adequate.

The following statement from Schulberg and Tolor would seem apropos to the reasons for the present study:

The Bender is regarded by four out of every five clinicians to have "some" or "great" value for diagnosis, regardless of the nature of their testing load or the nature of their patients. This general approbation would seem to indicate that the Bender will continue to play a vital part in the clinicians diagnostic armamentarium.

The Bender-Gestalt Test (see Plate 1) consists of nine white, 4 x 6 inch cards, upon each of which is printed a different geometric figure. Each design is printed in black along the horizontal axis of the card. With the exception of the first card, which is lettered "A", the remaining eight cards are numbered from 1 to 8.

The Subject, seated across the table from the Examiner, is requested to copy the designs on a sheet of white paper. On the table, in clear view, are additional paper and a rubber which the Subject may use if he wishes. The cards, which have been stacked face down on the table in front of the Examiner, are then placed, one at a time, face-up before the Subject, in the order A to 8. Each card is exposed for as long a period as the Subject requires in order to copy the design to his satisfaction. The test is ordinarily not timed.

1 p.351.
PLATE 1.
THE BENDER-GESTALT DESIGNS

A

......
1
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2
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3
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4
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5
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6
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7
......
8
Requests for further directions or help by the Subject are responded to in a non-directive manner, e.g., "...it's up to you" or "whatever way you think best." The finished product, i.e., the paper upon which the Subject has copied the designs, is usually referred to as the protocol or record.

The review of the literature in this thesis has been divided into two broad areas; studies using adults as subjects, and studies using children. Then, due to overlay and diversity of approaches to the test, the material using adult subjects has been further subdivided into: the effects of convulsive therapy, attempts to develop objective scoring methods, attempts to develop the test as a projective technique, research on rotations and recall, miscellaneous studies, including those on the effects of alcohol, regression studies, and finally, validation studies. The material covering studies with children follows the same general pattern, although studies of maturation and the relationship of the test to chronological age and intelligence are to be found in the section on children.

Naturally, there is a broad range in the levels of the studies. A few are highly sophisticated, well designed, and use good experimental populations and adequate controls. In contrast, a few are so trivial that they are not being mentioned. There are, in addition, a few studies which do
not contribute or apply to the problem in the present research. An attempt has been made to provide as complete a bibliography as possible, although it should not be considered exhaustive.
Chapter 2.
THE BENDER-GESTALT TEST

I. Theoretical and Historical Background

The nine geometric figures which make up the Bender-Gestalt Test (see Plate 1) were adopted by Bender from the thirty-two figures used by Wertheimer (119) in his classic study on visual perception, from which he derived the laws of "gute gestalten".

Bender's Monograph (7), which appeared in 1938, remains one of the most comprehensive studies of the test to date. She not only explored maturation in visual-motor perception in children, but also established tentative maturational norms for the years from four through eleven. In addition, she presented interpretative data from clinical studies with adults in the areas of brain damage, schizophrenia, the manic-depressive psychoses, mental deficiency and the psychoneuroses.

Although the origin of her work was based on classic gestalt theories of the former Berlin School (Koehler, Wertheimer and Koffka), she criticizes their theory that in the sensory field gestalten are directly dependent upon and replicas of the stimulus figure, as being too static to account for drives, growth, retardation and regression, i.e., underlying factors producing individual variations in the
reproductions of the designs. She insists, in agreement with Schilder in his preface to her Monograph, that, "The organism does not react to local stimuli by local events but reacts to constellations of stimuli by a total process which is the response of the whole organism to the total situation."¹ Thus the pattern of the response is determined by the integrative state of the organism reacting to the total stimulus. The individual not only perceives the stimulus figure but has a tendency to complete and reorganize the gestalten by biologically determined sensory motor patterns of action. The result is that levels of maturation as well as functional or organic states will tend to affect directly the reproduced designs in the Bender-Gestalt protocol.

Bender has concluded from her studies of the genesis of perception in young children that Wertheimer's principles of gestalt, other than continuity, "gute gestalt" and natural geometric forms, simply "do not apply to the genesis of gestalt in the maturation of the child's visual motor patterns".² In discussing the psychological principles of the test (6), she lists those factors which she believes determine the gestalt as follows: "the stimulating pattern... the motility of the visual field, which determines spatial relationships...the temporal factor...the motor reaction

¹ Schilder, p.vii in Bender's Monograph.
² p.Il.
patterns of the individual, and his attitude towards the task," and finally, "the immediate tendency for each of these factors to be non-separable from the others."\(^1\)

Bender's treatment of psychiatric categories in her Monograph is descriptive in that she only presents case histories and illustrations of the protocols. Although she obtained wide variations in the gestalt reproductions, these of necessity were exaggerated by the grossness of the disturbances, yielding clear-cut organic or functional signs and allowing little room for overlay which in less obvious cases presents a more difficult problem of diagnostic differentiation.

It is often stated in the literature that research on the Bender-Gestalt Test has tended to proceed in two directions: attempts to establish objective scoring methods and attempts to validate the test as a projective technique. Schildner pointed out the directions this dichotomy would take when he stated in his preface to Bender's Monograph, "Personal experience has taught me that the clinical value of the test is very great. It may allow a differential diagnosis between organic deterioration, so-called functional mental disease and malingering."\(^2\) This statement of necessity must be interpreted as the subjective evaluation of the protocol based on personal clinical experience, since

\(^1\) p.168.
\(^2\) op.cit., p.ix.
quantifiable methods, other than Bender's maturational norms, did not exist at the time.

Although there has been an abundance of literature on the Bender Visual Motor Gestalt Test since the publication of Bender's Monograph in 1938, the impetus to research did not occur until following World War II. This flowed primarily from former army psychologists who had been trained in the use of the Bender-Gestalt as a projective technique under Max Hutt who, during the war, was an instructor at the Adjutant General's school for Clinical Psychology and later became Chief of the Clinical Psychology Branch of the U.S. Army. Hutt, who had already had some experience with the Bender-Gestalt, found that it fulfilled the requirements of a brief, non-verbal test, relatively free from educational and cultural factors, and valuable as a projective screening tool in cases of brain injury or emotional breakdown. While with the army he wrote a training manual for the Branch of Clinical, which was "restricted", and in 1945 produced a tentative guide for the administration and interpretation, which he had mimeographed and distributed privately. The writer has been unable to obtain copies of either one of these papers, but has been advised by the Adjutant General's office that the revised contents of the former have been incorporated in Hutt's chapter, "The Revised Visual Motor Gestalt Test", which appeared in Contributions Toward Medical Psychology (A. Weider, Ed.), published in 1950.
This chapter, together with Hutt's other contributions, will be discussed in the section on the use of the Bender-Gestalt as a projective technique.

The few early studies on the Bender-Gestalt Test were executed by making cards containing individual figures from the plate in Bender's Monograph, since commercial cards were only made available to the psychological profession in 1946, the same time that Bender published a brief manual of instructions (5). This early research was primarily confined to the effects of cerebral insult on the gestalt reproductions.

II. Research Using Adults as Subjects

A. The Effects of Ablations and Convulsive Therapy on the Bender-Gestalt Test

Orenstein and Schilder (70), in a descriptive study of the effects of insulin-produced convulsions, urged patients to copy the Bender-Gestalt figures during stupor and after awakening. They found that characteristically the patients suffered aphasic symptoms as well as perseveration in the names or terms they used. The figures in the Bender-Gestalt protocols were grossly primitivized, while perseveration was a dominant feature. The aphasia was never found as an isolated phenomenon but only concomitant with the serious disturbances in the gestalt function. They pointed out that the disturbances they noted in the gestalt function were comparable to those observed by Bender in the toxic,
infectious and organic confusion, and sensory aphasia, and concluded that functions of large parts of the cortex are disturbed by insulin shock.

Schilder (89) investigating the use of metrazol-induced convulsions in treating schizophrenia, also found perseveration and the tendency to revert to primitive reproductions in the Bender-Gestalt protocols. He emphasized the disparity between disturbances found in protocols produced by schizophrenics and those following convulsions and stated that, "all these are criteria which proved, according to L. Bender, the deep organic disturbance of the form functions".¹

Stainbrook and Lowenbach (97), in a study of somewhat similar design to that of Orenstein and Schilder, collected patients' reproductions of several of the Wertheimer figures both before and at various intervals following electrically-induced convulsions. They noted that simultaneous with the patients' reintegration was improvement in their gestalt reproductions. The latter occurred in an orderly, patterned sequence.

In a comparatively recent study, Schon and Waxenberg (90) investigated the effects of hypophysectomy, the surgical removal of the pituitary gland at the base of the brain, by administering preoperative and postoperative Bender-Gestalts to twenty postmenopausal women suffering

¹ p.138.
metastatic carcinoma of the breast. They found that hypophysectomy resulted in a significant worsening of the protocols postoperatively, which they attributed to secondary hypothyroidism rather than surgery. The initial protocols, however, placed the majority of the subjects in Pascal and Suttell's (73) psychiatric category even before surgery, which suggests that similar research on postmenopausal women, ill and in a prolonged stress situation, might produce similar results. The design can be criticized for its lack of controls.

Pascal and Suttell feel that there is sufficient evidence to make the statement that, "the greater the damage to the cortex through convulsive therapy, amniation, lack of maturation, trauma, etc., the greater the deviations from the stimulus."

B. Attempts to Develop Objective Scoring Methods.

Three major attempts have been made to quantify the Bender-Gestalt in order to develop objective scoring methods for use with adult subjects.

In 1948, Billingslea (10) broke down the deviations or test determinants of the Bender-Gestalt into thirty-eight objectively defined factors which he was able to measure with 137 indices, i.e., lengths of lines, angles, areas, rotations and irregularities in shape. While scoring the indices, he was able at the same time to obtain scores on

1 p.9.
the factors. His initial scoring process required approximately fifteen hours per protocol, which necessitated the reduction of the number of indices to sixty-three and the number of factors to twenty-five. (See Appendix A). Having developed this method of scoring, he then applied it to the Bender-Gestalts obtained from 100 adjudged psychoneurotic male soldiers and 50 adjudged normal. Although three of his factors, closure, total rotation, and size difference, showed evidence of statistical reliability using the split-half technique, his method in general was not able to discriminate between psychoneurotics and normals. He concluded that the majority of his factors and indices tended to be unreliable and to lack validity. He added that he considered the test an excellent device for establishing rapport and observing client's behaviour in a test situation, and further opined that his results should not detract from the use of the Bender-Gestalt as a tool for intuitive observations.

Pascal and Suttell (73) have made one of the greatest single contributions to this area by building an objective, relatively simple scoring system based on the hypothesis that there is a direct relation between the frequency of deviations on the Bender-Gestalt protocol and the severity of the individual's pathology, assuming that both lie on a continuum. (See Appendix B). Thus the more severe the
psychiatric disturbance, functionally or organically, the greater the deviations in the reproductions of the Bender-Gestalt stimuli and the greater the total score. Using psychotic, psychoneurotic, and normal populations, they found that their Z scores were able to discriminate grossly between them. The fact that they were able to differentiate between neurotics and normals may have been due to their use of a total score, in contrast to Billingslea's method. Their data also indicated, in agreement with other studies, that the Bender-Gestalt reproductions are little influenced by sex, drawing ability, intelligence (within limits), or age. One of the limitations of the Pascal and Suttell scoring method is that their standardization group was composed of individuals from 15 to 50 years-of-age with the minimum of nine years of schooling. Although they utilized some children in the study, they have not published normative data for the conversion of raw scores to standard scores for children's populations.

Following Pascal and Suttell's, and Billingslea's diametrically opposed findings concerning the ability of the Bender-Gestalt to discriminate between normals and psychoneurotics, Gobetz (30), using adult males as subjects, isolated scoring elements which exhibited differential validity and combined them into a total score which was able to distinguish between the two groups. (See Appendix C).
However, when Gobetz applied Pascal and Suttell's scoring method to the protocols, it failed to differentiate between the groups.

C. Attempts to Validate the Bender-Gestalt as a Projective Technique

Any discussion of this area would be incomplete without consideration of the writings of Hutt (49, 50) who stands squarely in the foreground. Hutt, as mentioned previously, was possibly the individual most responsible for the acceptance, wide application, interest in and research on the Bender-Gestalt Test following World War II. Although Hutt has written, in collaboration with Briskin, a book on the interpretation of the Bender-Gestalt (50) and has contributed single chapters on the subject to several editions covering the field of psychodiagnostic techniques, he has not published his research findings in any specific detail. He is quick to denounce negative research results if the investigators did not follow his lead and conversely, quick to acclaim positive findings, if the research was in the direction he suggested.

In 1944 Hutt introduced minor changes in stimulus figures 2, 4, 5 and 6 and renamed his version the Revised Bender-Gestalt Test. His changes consisted of reducing the number of rows of circles in figure 2 from eleven to ten and slanting them slightly more to the left; reducing
the curvatures at the ends of the arc in figure 4; shortening the length of the sides of the arc in figure 5; and creating a perpendicular intersection of the lines as well as changing the point of intersection in figure 6. No research seems to have been carried out on the effect of the changes, although the revised figures are often used in projective studies. The psychological profession generally continues to use the original cards published by the American Orthopsychiatric Association.

Following the general procedure of administering the test, Hutt presents cards A, 2, 4, 6, 7 and 8 to the subject for the second time and asks him to modify the drawing in any way that is pleasing to him. The original reproduction together with the subject's modification of each figure is then presented to the subject and an inquiry made by the examiner in order to obtain associations to the modifications.

Hutt originally based his over-all evaluation and interpretation of the protocol on seven groups of factors: Organizational Factors, Factors Relating to Size, Changes in the Gestalt Form, Distortion, Movement Factors, Miscellaneous Factors and the Subject's Method of Work. Some of these can be traced to Bender's methods and others to the Rorschach. Under each of the major groups Hutt listed specific, significant factors which were evaluated by a kind of inspection technique. For example, under
Changes in Form of the Gestalt were listed closure
difficulty, crossing difficulty, changes in curvature and
changes in angulation. He then had a specific interpre-
tative hypothesis for each of these factors. For instance,
if a subject manifested crossing difficulty, i.e. manifested
deviations in his reproductions at points where one line
crosses another in the stimulus figures, Hutt interpreted
this sign as "...indicative of psychological blocking. It
is correlated with abulia, indecision, compulsive doubting
and specific phobias."\(^1\) Or, in speaking of movement
determinants under the group, Distortion of the Gestalt,
movement in reproducing the design from the outside toward
the centre was associated with "egocentric personalities
and strong narcissistic trends".\(^2\)

Hutt then grouped the factors together that could be
considered diagnostic signs in the different psychiatric
categories. These were in two sections; first, the
factors most frequently associated with the diagnostic
category, and second, the factors occasionally produced.
He stressed the necessity of a thorough understanding of
psychodynamics and psychopathology on the part of the
clinician in order to integrate the inferences drawn from
the protocol with the other test findings and the case
history.

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\(^1\) p.673.
\(^2\) p.677.
In his comparatively recent book with Briskin (50) on the clinical use of the test, he has reduced his major groups from seven to five; Organization, Size, Changes in Form, Gross Distortion, and Movement. (See Appendix D). He has also produced a simple scoring method for the variables. He has, however, given up his strong emphasis on configurational analysis in establishing nosological psychiatric categories since he rejects the basic assumption of homogeneity underlying each diagnostic category. He claims that the use of scores for the purpose of defining psychiatric categories or evaluating severity of pathology are of limited value. Instead, he suggests that the proper use of the Revised Bender-Gestalt is in predicting surface traits and uncovering process phenomena. The latter he interprets psychoanalytically. He expresses his confidence in his method in his statement "It has only been relatively recently that 'research validity' for the RBGT has begun to catch up with the 'clinical validity' that competent clinicians have offered for this test."¹

Kitay (55) was among the first to investigate any area of the Bender-Gestalt as a projective technique by correlating size deviations from the stimulus figures with selected Rorschach scores. His only significant critical ratio was between subjects who had a general tendency toward expansion

¹ pp.20-21.
and high CF + C with low FC and those who had a tendency toward contraction and low CF + C with high FC. He concluded that expansion of the reproductions appears to accompany uncontrolled affect, while contraction accompanies controlled affect.

Suczek and Klopfer (104) studied the stimulus properties of Hutt's Revised Bender-Gestalt figures by having college students of both sexes associate to each figure projected on a screen. Then, using the inferential method of interpretation, they established a tentative, interpretative hypothesis for each figure based on the number and kinds of associations produced as well as their main features and characteristics. They claimed consistency as well as sexual differences in the content, although there was no statistical treatment of their data.

Tolor (115) focused on the structural properties of associations to the designs rather than on their symbolic significances. Using 50 adult neuro-psychiatric patients, he obtained their associations by a method somewhat comparable to eliciting Rorschach responses. He then categorized and classified the responses and found that the figures vary considerably in their stimulus value, i.e., some are so difficult that they produce only rejections, descriptions, or vague, non-specific associations, while the patients could associate quite readily to others. Figure 3 seemed to be the easiest, while figure A appeared
to be the most difficult.

In a recent study, Tolor (114) used the semantic differential method in investigating the meanings of the designs. He exposed each design for a three-minute interval to 68 college students while they rated it on a set of bipolar adjective scales having 7 spaces between the poles allowing both direction and intensity to each judgment. The meanings were necessarily limited by the specific scales used. However, 79 of the adjectives were significant at the .05 level on the combined sample, which suggested close agreement by members of both sexes in their responses to the designs.

In a follow-up study of symbolism, Hammer (41) administered the Bender-Gestalt to 20 males immediately prior to eugenic surgical sterilization. His controls were matched patients about to undergo surgery for other purposes. The protocols of the two groups were then compared and 22 test items relating to castration fears were isolated, all of which were significant at, or better than, the .05 level of confidence. Several of the factors supported individual hypotheses of Suczek and Klopfer's concerning phallic symbolism. The study is weakened by the discrepancy in intelligence to the advantage of the control group, as well as by the diversity in psychiatric categories.
Although the author acknowledges the former, he fails to take it into consideration in accounting for his indice of regression.

Among other studies in this area, Story (101), investigating the protocols of male alcoholics, found that in design 6 his experimental group made significantly more liquid responses in both their elaborations and associations than his control group.

Peek (75) explored the single factor of directionality used in drawing the diagonal projection in figure 5, i.e., whether the subject started at the top and drew the dots in the direction of the half-circle, i.e., toward himself, or extended the projection from the half-circle outwardly, i.e., away from himself. In 75 cases of hospitalized male neuro-psychiatric cases who drew the projection toward themselves, a significantly greater proportion had psychosomatic complaints in their hospital discharge summaries than in the control group. Many of the complaints, however, appeared often enough in both groups to warrant caution in the interpretation of the sign.

D. Research on Isolated Segments of the Bender-Gestalt.

1. Rotations.

In 1950, Hanvik and Anderson (44) obtained protocols from 20 patients whose cerebral lesions were found either through surgery or X-ray to be localized in the dominant
hemisphere, and 24 patients with cerebral lesions in other areas. These were compared with protocols of patients hospitalized for either functional or organic lower back pains. After the usual administration of the Bender-Gestalt, the subjects were requested to draw the figures from memory. The only finding of statistical significance was that the brain-damaged patients, as a total group, rotated at least one figure in their reproductions in more instances than the control group. This brief, rather innocuous paper, was one of the first of a series of research projects both in the areas of recall and rotations.

Hannah (42), protesting against the undisciplined use of interpretations of the Bender-Gestalt while failing to consider its innate limitations, dramatically demonstrated that significantly fewer rotations were produced by his experimental group when the stimulus figures were placed on the cards in a vertical orientation, corresponding to the presentation of the copy paper, than in the usual horizontal position.

Griffith and Taylor (38), in a replication of Hannah's study, merely rotated the paper to the horizontal position when presenting it to the subject. Their results confirmed Hannah's findings. They concluded that often rotations are caused by the subject's orienting the design to the major axis of the paper in order to duplicate its orientation on the card.
In a previous study, Griffith and Taylor (39) had attempted to ascertain the frequency of rotations in a neuropsychiatric hospital population; their criterion of rotation was 45 degrees or more in an otherwise recognizable figure. In a total of 1003 protocols taken from hospital records, they found that 23% made one or more rotations, with schizophrenics, neurotics and character disorders about equal (19.7, 19.8 and 16.4). The percentage within the chronic brain syndrome was 40.8%. This throws little light on the frequency of the occurrence, since there are no available statistics on normal adults.

2. Recall.

Gobetz (30) was one of the first to investigate recall, i.e., the reproduction of the figures from memory after the usual administration, by including it in his quantification study of normal and psychoneurotic adults. He hypothesized that the absence of an objective stimulus would accentuate the difference in the reproductions of psychoneurotics and normals and that emotional blocking in the psychoneurotics would reduce their ability to recall the figures. Although he found distortions in the recalled figures of both groups, there were no significant differences either in their reproductions or in their ability to recall.

Following several studies (2, 36, 112) in which the recall method was used to investigate functioning intelligence,
design difficulty, serial position, and sex differences, Olin and Reznikoff (69) quantified the recalled productions by using Pascal and Suttell's scoring system together with 19 indices adapted from Pascal and Suttell for use in scoring figure A. They used this method in a replication of a portion of Tolor's study (112), in which he had used an organic group, a seizure group, and a psychogenic group and had concluded that his psychogenic group was superior in recall ability with the convulsives occupying an intermediate position. Olin and Reznikoff found organics and convulsives identical in their ability to recall. Both studies indicated that although psychogenics were superior to organics, the technique was not sensitive enough to be used in individual cases.

The discrepancies obtained in some of the studies, (2, 112, 68) have produced some rather dubious answers to the questions of the relationship between recall and functioning intelligence, the ability of recalled productions to discriminate between organics and schizophrenics, and which designs are easiest to recall. The only areas of agreement in any of the studies (112, 113, 66, 69, 36) are that designs 3 and 4 are the most difficult for all groups, and that organics generally are less accurate in their ability to recall the designs.
3. Other Areas of Investigation

Other diverse areas have been explored which underscore the quantity and quality of the research which interest in the test has produced.

a. Alcoholic Studies.

Three studies (52, 101, 18) since those of Bender (7) have investigated the Bender-Gestalt reproductions of alcoholics. In each study the numbers were small, and the experimental designs called for adult, male subjects. Kates and Schmolke (52), using the Pascal and Suttell scoring system, compared 18 institutionalized alcoholics with 18 custodial workers matched for age and educational and socio-economic background. They found no significant differences in the protocols of the two groups. Curnutt (18), in a very similar study, compared the protocols of 25 members of Alcoholics Anonymous with a matched control group of non-members, again using the Pascal-Suttell system. In addition, he empirically investigated a configuration of signs which he believed to be unique to alcoholics. In contrast to Kates and Schmolke, he obtained a significant difference between the mean scores of his groups. He concluded that three of his empirical signs were unique to the alcoholic group, but offered no statistical treatment of that portion of the data. One questions the groups from which the controls were selected in both Kates and Schmolke's,
and Curnutt's study.

Recently, Story (101), using the Revised Bender-Gestalt, tested several projective hypotheses concerning the kinds of differential productions which would be obtained from alcoholics. His groups were 30 male alcoholics and 30 school teachers. His factors were related to compulsivity, anxiety, low stress tolerance, suppression of affect, and oppositional tendencies. His results indicated that his scoring method of the Revised Bender-Gestalts significantly discriminated between his groups and supported his hypotheses. One questions if his factors would be able to discriminate between alcoholic and neurotic groups.

b. Regression.

Regression, or the tendency to revert to more immature or primitive levels in reproducing the gestalt stimuli, has been discussed by Clawson (14) and Byrd (13) and frequently considered a diagnostic sign (7, 4, 51). Suttell and Pascal (107) attacked the problem of regression by obtaining reproductions of five sizable groups; schizophrenics, nonpatients, psychoneurotics, and two groups of normal children, ages 6 to 9½ and 10 to 14. They found four significant factors in which the schizophrenics and younger children resembled each other, yet differed from the nonpatient adults; shape of circle, deviation in slant, workover, and tremor. Suttell and Pascal alleged that these
four items were all dependent on learning rather than on 
maturation of capacity, and as such represented a disruption 
of a learned motor response, suggesting failure to control 
rather than a return to an earlier level of capacity. Thus 
they concluded that the similarity in the young child's and 
the schizophrenic's reproductions are superficial in nature.

Crasilneck and Michael (16) compared the Bender-Gestalt 
protocols of ten hypnotized subjects instructed to regress 
to the age of four, with Plate 62 in Bender's Monograph. 
They roughly calculated that the mean mental age of the 
reproductions obtained in this manner was 7.3 years.

c. Miscellaneous

The literature to be reviewed in this section has little 
continuity, but illustrates further attempts either to assess 
the Bender-Gestalt's usefulness in specific areas or to add 
to the general body of knowledge about it.

Pacella (71), in a recent study, investigated the 
influence of the examiner on the subject's performance of 
the Bender-Gestalt Test. His group, which consisted of 9 
normally adjusted women, was administered Bender-Gestalts 
by four different examiners over a four-hour period. The 
fourth examiner's role was that of the stress factor, which 
was introduced by hostile, deprecating remarks during the 
testing. Administration was in random order.

The protocols were scored by the Pascal-Suttell method
and, in addition, three judges attempted to identify subjectively the protocols produced by the stress factor. The author concluded that performance on the Bender-Gestalt is not influenced by stress or inter-examiner differences since no significant differences were obtained nor were the judges able to identify successfully the stress protocols.

It would seem that the author's conclusions could only be related to these nine normal women. Further research with larger groups, adequate controls, and standardization of the stress factor would be necessary before generalizations could be made.

A neglected area of research has been the manner in which the subject carries out the instructions to copy the stimulus designs. Woltman (121) mentioned that deviations in coping with the test are of diagnostic importance and may be indiscernible in the completed protocol. The only study in this area is a very limited one conducted by Stennett and Uffelmann (99). They recorded each subject's method of copying the figures on mimeographed sheets of the designs and found a definite tendency for the drawings to be completed in specific ways common to both patients and controls. They obtained no significant correlation between "atypicalness" and mental illness.

Tucker and Spielberg (116) compared the Bender-Gestalt's of 18 depressed patients with those of a non-depressed
control group on twenty separate test items taken from the Pascal-Suttell system. Only two items, tremor and distortion, separated the two groups, and these were only at the .05 level of confidence. A provocative trend was that the nondepressed patients took longer than the depressed to complete the protocols.

E. Validation Studies of the Bender-Gestalt Test

Validation studies inevitably followed the vast quantity and variety of research which appeared on the Bender-Gestalt, particularly following the publication of Pascal and Suttell's scoring system which provided quantification and standardization. Investigations were made of the subjective use of the test as well as of objective scoring methods. Here too, the quality of the research is not consistent and the results are seldom in agreement.

1. Subjective Studies.

Mehlman and Vatovec (67) invited eight experts to take part in a blind analysis experiment in which they were to separate functional psychotics from organics in 25 pairs of matched protocols. They defined "expert", as an individual who had published accounts of clinical research and who had expressed enthusiasm for the test. Of the eight, only three of the authorities participated. Two of them closely approached better than chance success, while the third failed to meet the criteria. As Mehlman and Vatovec point
out, in this situation the judge's task was far easier than that met routinely by the clinician, which suggests the need for further refinement in the use of the test.

Peek and Storms (76) had three judges estimate the intellectual level, and extent of impairment in the Bender-Gestalt protocols of 100 psychiatric non-neurological in-patients. The patients' Shipley-Hartford Scale scores were used as the criterion of both intellectual level and degree of impairment. Intelligence ranged from low average to superior, while degree of impairment ranged from very severe to none. Although the results were statistically significant for many of the judgments, agreement in the judges' ratings was not significant at the five percent level, and only one judge's estimates of impairment were significantly higher than chance. The estimates also seemed to vary in relation to the amount of experience each judge had had with the test. The authors concluded that their findings did not support the use of subjective estimates of Bender-Gestalt protocols for purposes of judging intelligence or degree of intellectual impairment in individual cases.

In a Veterans' Administration study, Goldberg (31) had three groups of judges--psychology staff, psychology trainees, and secretarial workers--attempt to differentiate between 30 protocols, half of which were produced by
diagnosed organics and half of which were produced by psychiatric ward patients. He found little difference in the diagnostic accuracy of the three groups in that they all reached a better than chance level of correct diagnoses, with an average of 68%. The nonprofessionals, however, expressed more confidence in their judgments than the other two groups. The protocols were then scored by the Pascal-Suttell method and the results compared with the placements of the best clinical judges in the group. The result was that the techniques were found to be about equal in accuracy. In considering the base rate of organic patients encountered in clinical practice, which Goldberg considers to be about 20%, he concluded that the chances of misdiagnosis of organicity could be increased by using the Bender-Gestalt for this purpose.

2. The Bender-Gestalt as a Prognostic Indicator

Following Pascal and Suttell's (73) report of the ability of their Z scores to predict the prognosis of mental patients, Swenson and Pascal (108) compared the Z scores of two small groups of patients administered the Bender-Gestalt upon admission to a mental hospital and their evaluations by the hospital staff as "improved" or "unimproved" a year and a half later. Their findings were very similar to Pascal and Suttell's, i.e., that the patient obtaining a low Z score on admission has a better chance of
improving than the patient with a high Z score.

Lothrop (63), studying duodenal ulcer patients, obtained results that indicated that Pascal and Suttell's raw scores could separate preoperative ulcer patients from those for whom merely medical treatment would be successful. He further claimed success in predicting postoperative successes and failures among patients considered to be intractable. This is a limited study in that he had only nine subjects in each of his groups.

3. Psychiatric Group Discrimination

Unfortunately, the four major validation studies of the Pascal-Suttell scoring system have been carried out in Veterans' Administration installations in the United States, limiting the subjects in these specific instances to adult, male veterans of the armed forces. Thus the results can only be generalized with caution.

One of the first studies was by Robinson (83), who compared the performance of parietics, and schizophrenics with no known cortical deficit. Her data indicated that although overlap was great, the raw score means differentiated the two groups at the .05 level of confidence, which supported Pascal and Suttell's findings but precluded the use of the technique in diagnosing individual cases.

Lonslein's (62) results, in a similar study of 96 protocols, indicated that the raw score means as well as
the standard score means differentiated significantly psychotics from nonpsychotic patients. When a cut-off score of 65 rather than 60 was applied, as suggested by Pascal and Suttell, the technique separated the two groups in about 7 out of 10 patients, again suggesting that the technique is not infallible.

A more thorough investigation of the system was made by Bowland and Deabler (12). Using four groups—normals, neurotics, organics and schizophrenics—they obtained two protocols from each subject, the first administered at the beginning of a 2½ hour test battery and the second at the end of it. The pairs of protocols were then coded and randomized and subjectively judged by seven psychologists as normal, neurotic, schizophrenic, or organic. The pairs of protocols were also scored by the Pascal-Suttell method. The results indicated that the frequency of correct ratings by either method, i.e., subjectively or utilizing the scoring system, exceeded the chance expectation beyond the probability of .001.

Tamkin (109), protesting against the lack of controls matched for age in the previous studies, as well as other variables such as degree of chronicity and educational background, again investigated the ability of the scoring system to discriminate between functionally psychotic and nonpsychotic mental disorders. He carefully controlled
for age as well as degree of psychopathology by means of the MMPI, F, and Critical Item Scales. His findings sharply disagreed with those of the previous studies in that the Pascal-Suttell scoring system was not able to discriminate between the two groups, nor did the scores correlate with the indices of psychopathology obtained with the MMPI.

III. Research Using Children as Subjects.

A. Introduction

In many ways, the literature covering the research in which children have been used as subjects is more difficult to categorize than the adult studies. This is only partially due to the additional variables of chronological age and maturational factors. Scoring methods have often been created as adjuncts to the research, and isolated discussions of such phenomena as rotation and primitivation may be found spread across the literature. In instances where studies have used experimental groups whose age ranges overlap both children and adult populations, the research has been arbitrarily included in this section.

B. Developmental Studies and Scoring Methods

1. Maturational Studies

In discussing the maturation of visual-motor patterns in children, Bender (7) theorizes that from the age of
about two and one-half to four years the child can only produce scribbles with the pencil or crayon. These involve gross muscular movements resulting in large whirls or pendulum-like waves. They are in a clockwise direction if the child is right-handed and counter-clockwise in the left-handed. These are meaningless figures and in the early stages offer little more than awareness of movement and muscular expression. Through inhibition, however, these scribbles are gradually reduced to primitive closed or partially closed loops with which the child can represent objects. The child also develops the control to make dots, dashes and broken lines, usually through imitating others. Perseveration of any learned patterns formed by this method is common at this time in almost all of the child's representations.

From the ages of four through seven, rapid motor development, control and differentiation take place which result in the ability of the child to represent graphically his interpretations of the world of people and objects which surround him.

Unfortunately, Bender offered no statistical treatment of her data. Her maturational study was based on percentages of successful drawings at each age level in a population of eight hundred children ranging in age from three through eleven years. She claims that this offers a satisfactory test of
maturational level of visual motor gestalt functioning between the ages of four and eleven years and provides a series of "average" drawings at each age level with which the clinician may compare drawings and estimate the functioning level of the child. At best, this is a crude instrument, although the studies of Pascal and Suttell offer support to her findings, and numerous investigations (28, 35, 73) agree that maturation of capacity is of great importance in children's perceptual motor performance.

Bender further claims that at age 11, all of the figures can be successfully reproduced and that beyond this age, the normal individual only improves in motor control and in refinement of details.

Fabian (23), in his study on rotations, speaks of an inherent genetic factor in visual perception whereby the ability to perceive configurations is gradually developed in the child, while scribbling, circular or whirling movements, perseveration and primitive gestalt tendencies slowly disappear or are inhibited.

Harriman and Harriman (47) tested Bender's postulate that visual motor perception is a personal function dependent upon maturational level, by hypothesizing that the Bender-Gestalt protocols of normal children who were making satisfactory progress in reading would more closely resemble

normal adults' reproductions than those of normal pre-readers. Comparing the protocols of a group of nursery school children with a group of second graders' they found that the four factors, orderliness, absence of syncretistic effects, freedom from overlapping, and avoidance of an increase in size, significantly discriminated between the two groups. Although they attribute some of the discrepancy to the fact that the older children had been trained in task-oriented work, their conclusion that the variances "seem to be the result of important differences in maturational levels", does not seem completely justifiable, since each of the significant factors is directly related to and transferable from learning both in reading readiness experiences and in the actual reading process.

In a singular contribution, Keller (53) attempted to build a scoring system designed for the specific purpose of measuring visual motor maturation level in mentally retarded boys. His object was to create a measuring device free from indices influenced by personality and adjustment factors, while retaining only those factors which reflect maturational level. As a result, his indices fell into the areas of spatial relationships, visual motor coordination in the execution of dots and circles, and reproduction of the appropriate number of elements. He used a check list which

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1 p.177.
provided a total score based on the number of indices successfully executed by the child.

Although the numbers used in the statistical evaluation were small, Keller compared results of subjective ranking of maturational level of the protocols with ranking by his scores, and obtained rank order correlations of .93 for both raters. There was also a trend for the Bander-Gestalt method to correlate more highly with classroom performance than the Stanford-Binet or the Grace Arthur Scale. However, this is not unpredictable, since in this particular setting, classroom activities were primarily composed of visual motor tasks. It is doubtful that Keller has completely eliminated psychogenic variables or that he has incorporated all of the indices of maturation, as Ingram pointed out in her discussion of this paper.

Keogh and Smith (54) have recently investigated a scoring technique with Kindergarten children based on a five-point rating scale for each design, yielding a total score for the protocol. Their method was to have each figure copied on a separate sheet of paper and then to evaluate each reproduction and assign a score according to its fulfillment of the rating scale definitions which ranged from "not recognizable as the design figure" to "all parts

1 Winifred Ingram, Ph.D., Discussant following presentation of paper at 1954 Annual Meeting of the American Ortho-Psychiatric Association.
of the design present and recognizable in good form. They obtained high correlation coefficients between the rating of three judges as well as with the raw scores obtained with the Pascal-Suttell scoring method.

In the same study, Keogh and Smith investigated group administrative techniques with children and found no significant differences in the protocols whether administered individually or in a group.

2. School Readiness and Reading Disabilities.

In another recent study, Lachman (60) questioned the hypothesis that reading disability is accompanied by a lag in perceptual-motor development. He hypothesized that if this is so, the protocols of normal children retarded in reading would reveal more manifestations of perceptual-motor immaturity than those of normal children with normal reading ability or than those of emotionally disturbed children with normal reading ability. Using five types of distortions considered by Bender to be indicative of developmental lag in this area, he recorded their presence or absence in the protocols of children in each of the three groups. His results indicated that although there was a significant difference between the normal retarded readers and the normal children in the expected direction, the distortions did not differentiate significantly between
the normal children who were retarded in reading and the emotionally disturbed children with normal reading ability. It would seem that one explanation of Lachman's findings is that he accepted referral of the retarded reader to a reading clinic rather than to a mental hygiene clinic as an indication of freedom from emotional problems in the child.

Koppitz (58) explored the sensitivity of the Bender-Gestalt to learning problems in young school children. She screened out 7 deviations, some of them adapted from the Pascal-Suttell method, which on the basis of a total score significantly discriminated between good and poor students when applied to 77 children in the first four grades of school. These deviations roughly fell into three areas; the inability to control lines both in directionality and in shape, the inability to integrate parts into wholes, and the inability to control and terminate visual motor activity. The deviations found in these three areas were also found by Pascal and Suttell in the protocols of their very young children, and rarely occurred in the reproductions of their psychotic patients. Thus Koppitz hypothesized that they are indicative of immaturity in young children, although they may suggest retardation or brain damage in older children.
C. The Relation of the Bender-Gestalt to the Chronological Age and to the Intelligence Quotient

1. Chronological Age

In general, Bender (?) says that the evolution of visual motor gestalten is a maturational rather than an educational process and that by the age of eleven years, all of the figures can be clearly perceived and reproduced. She notes that beyond the year seven there is very little change in the figures other than in improvement of obliquity and in an increase in the number of combinations. This suggests that their evaluation increases in both difficulty and subjectivity. Byrd (13), whose maturational findings support Bender's, points out that although the maturation process is not completed at earlier ages, the test is nevertheless useful in evaluating other factors than the simple ability to perceive and reproduce designs. Koppitz (58) states that "very few children under the age of nine years can reproduce the figures accurately."¹ Hutt and Briskin (50) do not recommend the use of the test with children younger than seven, since below that age the child has not enough visual motor ability to copy the figures adequately.

In addition, Hutt and Briskin state that the test factors not greatly affected by age are: the position of the first drawing, sequence, use of space and margin and size. In contrast, Harriman and Harriman's (47) findings

¹ p.294.
indicate that all of these factors are related to age. Hutt and Briskin list rotation, closure, angulation, simplification, fragmentation and crossing as the factors related to age, especially in young children. They suggest that consistency or inconsistency in the presence or absence of a factor is to be considered in determining whether it is a product of maturation. Factors which appear inconsistently at any level are more often produced by emotional causes.

There is little agreement as to the age at which one can be sure that maturational factors are not responsible for distortions on the Bender-Gestalt. Quast (80) suggests 10 years, Hutt and Briskin (50) suggest 18, Byrd (13) suggests 16, and Pascal and Suttell (73) suggest that there is a levelling off between the ages of 15 and 50. Only Bender (7) offers maturational norms and these suggest 11 years.

Pascal and Suttell (73), using 46 children ranging in age from 6 years, 3 months to 9 years, 3 months, obtained a product moment coefficient of .58 between Bender-Gestalt raw score and age in months. They noted, however, a tendency for the raw scores to drop with increasing age and suggested that the restricted range may have attenuated the obtained correlation coefficient. In brief, while there is a definite relationship between chronological
age and ability to reproduce the Bender-Gestalt figures, the literature is primarily descriptive in this area. However, Pascal and Suttell's maturational findings are in essential agreement with those of Bender.

2. Intelligence.

Bender states in her monograph (7) that "The copying of these figures by children is a test which shows the maturation level of the child in the visual motor gestalt function...a fundamental function...closely associated with the various functions of intelligence...."¹ She stresses that the Bender-Gestalt is more comparable to performance tests than other types of tests, partly due to the fact that it is a test of maturational processes rather than language ability or educational achievement. In discussing her findings with mentally retarded children, she points out that mental retardation is not necessarily evinced in the reproductions simply by a lowered level of reproduction, which would be commensurate with the mental age obtained by intelligence tests, although occasionally this can happen. She suggests that a greater variety of reproductions can be obtained among retarded children than among normal children of the same mental age, and considers that psychodynamics play an important role. Goodenough (35) also mentions that children of inferior mental ability may

¹ p.112.
copy well but rarely produce good original drawings. Thus, while it is acknowledged that intelligence is related to the ability to reproduce the designs, its specific role and its indices in the protocols have not been adequately investigated.

Pascal and Suttell in the study mentioned with children, obtained a product moment coefficient between the Bender-Gestalt score and the I.Q. of -.05. They then partialled out the effect of chronological age and obtained a partial r of +.03. They concluded that their Bender-Gestalt scores were not a function of intelligence.

In an earlier study, Sullivan and Welsh (105), exploring the effects of poliomyelitis on children, found no significant correlation between their total Bender-Gestalt scores and intelligence as measured by the Stanford-Binet.

The problem of whether performance on the Bender is primarily a function of intelligence or dependent on other functions was directly attacked by Koppitz (59). She administered the Bender-Gestalt and the WISC to 90 school children ranging in age from 6 years, 7 months to 11 years, 7 months. Their average IQ was 95 with a range from 73 to 126. Twenty-eight of the children had been referred to a Children's Mental Health Center because of behaviour problems, while the remaining 62 were referred
because of learning problems. Using her scoring method mentioned previously, she obtained a composite score on the Bender-Gestalts and evaluated them on the basis of age norms previously established from the protocols of several hundred children. She then compared the various WISC measures with the composite scores. Her results indicated that there is a highly significant relationship between the Full Scale I.Q. and the Bender-Gestalt in the third and fourth grades of school (ages approximately eight to nine years), which appears as only a trend in the first and second grades (ages approximately six and seven years). This suggests that in the lower years the Bender-Gestalt may be more closely related to maturational factors in visual motor perception than to general intelligence. The Verbal I.Q. shows the reverse trend, i.e., it is significantly correlated with the Bender-Gestalt during the first two years of school but is reduced to only a trend during the third and fourth years. The latter findings support Bender’s theory that the maturation of the visual motor gestalt function is closely associated with the maturation of verbal abilities. Koppitz also found that the Performance I.Q. is consistently significantly related to Bender-Gestalt performance at all ages.

3. Drawing Ability

Pascal and Suttell (73) found that drawing ability
has little effect on the Bender-Gestalt scores, while Peoples and Moll (77) also found that it seems to be unrelated.

4. Sex

An outstanding feature noted in reviewing the literature is the paucity of information concerning the effect on children's Bender-Gestalt reproductions of the sex of the subjects. In adult studies, both Pascal and Suttell, and Gobetz (30) found that within the normal range of intelligence or above, the sex of the subjects does not affect the scores.

D. Studies Exploring the Use of the Bender-Gestalt as a Projective Technique

In a descriptive study with children during latency and early adolescence, Greenbaum (37) asked them what the designs reminded them of following the standard administration. He then inserted their associations in the Rapaport-Gill-Shafer list and administered it to them on their return visit to the clinic. Although no statistical evidence is offered, Greenbaum claims that about one-third of the associations obtained in this manner have been fruitful.

Clawson (14) in an empirical study compared the protocols of 80 children exhibiting maladjustive behaviour with those of 80 normal children, in an effort to determine
interpretative significance in the maladjusted children's reproductions. She utilized deviations hypothesized by Hutt (49) and Billingslea (10) to have interpretative significance in adult records and compared them with the children's Rorschach patterns of determinants. Her results allowed her to conclude that an expansive arrangement of the figures is diagnostically significant as an indicator of acting out behaviour, whereas, a compressed arrangement reflects a tendency to withdraw; that constricted figure size indicates controlled affect; that difficulty with closure is an indicator of difficulty in interpersonal relations; and that in the drawing of the projection in Figure 5, the well adjusted have a tendency to draw the line away from themselves, while the emotionally disturbed draw the line in an inward direction. These findings support Hutt's hypotheses.

E. Attempts to Identify Psychiatric Groups

In Bender's monograph on the visual motor gestalt test (7), she described psychiatric categories in detail by the use of short case histories of individuals suffering the illness, together with illustrations and discussions of their protocols. She sometimes used both children's and adults' protocols in discussing the same psychiatric category. She seldom, if ever, used borderline cases as
illustrations, but rather individuals suffering severe pathology of long duration. Her efforts offered little to the clinician in methods of interpretation or identification, although in some instances she grouped together the signs most frequently found in the protocols of the psychiatric group under discussion.

In evaluating a child's record, Hutt and Briskin (50) recommend that the first step is to determine maturational level by the child's success or failure in reproducing the circle, square, and diamond as employed by Terman and Merrill (110). They then suggest that the protocol should be interpreted by inferential analysis in which the reproductions are utilized as a projective test and the dynamic and behavioural characteristics of the individual's functioning portrayed, rather than by attempting to arrive at a differential diagnosis.

In 1956, Byrd (13) made one of the first attempts to identify psychiatric groups using a children's population. He did not attempt to discriminate between specific psychiatric categories, but rather between children who had been evaluated as in need of psycho-therapy and those who were considered well-adjusted. His experimental group consisted of 200 children, between the ages of 8 and 16, who had been evaluated in child guidance clinics as being
in need of psychotherapy. His other criteria consisted of an I.Q. of above 85, correction for visual impairment and freedom from known brain damage. His control group consisted of 200 children independently judged as "well-adjusted" by at least two adults. Byrd used fifteen factors postulated by Hutt (49) as having significant diagnostic interpretative ability, thirteen of which Hutt considered signs of psychopathology in adults. (See Appendix E.) Byrd found that many of the signs followed maturational sequences and that only four of the original fifteen factors differentiated the two groups at all ages; orderly sequence, change in curvature, closure difficulty, and rotations.

As an adjunct to their study to establish normative data with adults, Pascal and Suttell (73) matched 12 non-patient children with 12 children suffering psychogenic disorders, ranging in age from about 6 years, 6 months to 9 years, 9 months. They found that their scoring method significantly discriminated between the two groups. Although their numbers were small, they further concluded that their scoring method was measuring "something similar to that which it measures in adults",¹ in addition to maturational factors.

Adolescent delinquents were used in two studies (123, ¹ p.42.)
19) In attempts to differentiate behavioural groups by the use of Pascal and Suttell's cut-off scores, Zolik (123) found that by raising the cut-off score from 60 to 72, the method was able to differentiate significantly 43 individually matched delinquents from their non-delinquent opposites. However, Curnutt and Corotto (19) found that neither Zolik's nor Pascal and Suttell's cut-off scores could differentiate between their groups. It would seem that Curnutt and Corotto's definition of the term delinquent, "An adolescent having had one or more contacts with a juvenile court, as well as a court placement in a children's psychiatric service for observation," would greatly reduce the possibility of homogeneity in the experimental group.

Curnutt and Corotto (15), again using the Pascal and Suttell method, investigated the ability of the Bender-Gestalt to discriminate between an aggressive and a runaway group of adolescents of both sexes. Their results indicated that the aggressive males made significantly lower scores, suggesting more ego control than the flight males, while in contrast, the female flight group made significantly lower scores than the aggressive females, again interpreted as demonstrating more ego strength.

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1 p. 354.
F. Studies of Effects of Cerebral Dysfunction

In the late forties, Sullivan and Welsh (105) included the Bender-Gestalt in a battery of tests investigating the effects of poliomyelitis on the intelligence and personality of school age children. Their research was not mainly directed at ferreting out signs of organicity in the protocols, but was more a search for secondary personality factors resulting from prolonged or severe illness. Using the protocols of 49 matched pairs of children, they had the subjects draw each figure on a separate sheet of paper. They then judged each figure against an a priori set of characteristics for motor control, intellectual control and affective control and assigned a score from one to three, i.e., 'below average', 'average', or 'above average', obtaining a total score for each protocol. Their method was unable to discriminate the protocols produced by the polio children from those of the normal children.

The Pascal and Suttell scoring method was used by Shaw and Cruickshank (93) in a study of 25 institutionalized idiopathic epileptic children matched with a group of 25 institutionalized non-convulsive children. Analysis of the total scores indicated that there was no significant difference between the mean scores of the two groups. However, the configurational score was able to separate the two groups at the 2% level of confidence. Thus the
real differences between the two groups seemed to be closely related to placement, size, and the order of the designs on the paper. Shaw and Cruickshank concluded that the results were not due to the presence of a confusing background resulting from perceptual difficulties, but could be more readily attributed to the inability to organize thought processes in an orderly fashion in the idiopathic population. They ruled out the possibility of the background's causing confusion since the original background was only a plain piece of paper. However, they failed to take into account the fact that each time the child reproduced a design, he was automatically creating more background for the following reproduction.

Several investigators have used the Bender-Gestalt in studying brain-injured children. Feldman (24) compared the protocols of a matched group of 54 exogenous and 54 endogenous mentally retarded children and adults, ranging in chronological age from approximately 12 to 43 years. He used the Pascal and Suttell method and found that the mean performance was significantly poorer in the exogenous group. Halpin (40), using only children, compared a group of 15 exogenous with 15 endogenous and found that the exogenous group produced significantly more drawings judged as "unrecognizable" than the endogenous group.
Bensberg (8), in a more extensive study, compared the reproductions of 161 brain-injured children and adults with a matched group of familial defectives, whose mental ages ranged from 3 to 12. Their chronological ages ranged from 7 to 61 years. He then assigned an age score to each figure based on Bender's maturational chart. His results indicated age trends as well as a significant difference in the reproductions in favor of the familial defectives.

Cruckshank and Bice (17) used 216 cerebral palsy children, the majority of whose I.Q.'s were above 70, with a matched group of normal children. The performance of the cerebral palsy children was significantly inferior as compared with the normal children, with only 5 subjects in the group able to reproduce all of the designs satisfactorily. It would seem that the design of this study was loaded in the direction of the results, i.e., Bice was comparing physically normal children with those suffering some degree of motor impairment. Feldman's and Bensberg's studies were possibly dissipated by the wide range of chronological ages in their groups.

Quast (80) attempted to validate 17 attributes or signs which he found to be most common in the protocols of brain-injured children and adults. His subjects were 50 suspected emotionally disturbed children without suspected brain damage, and 50 children with suspected
brain damage, with or without emotional disturbance. The subjects were from 10 to 12 years-of-age. The protocols were scored as to the presence or absence of the 17 attributes and 10 of them, Scalloping, Dashing, Perseveration, Rotation, Reversal, Confabulation, Angulation, Major Distortion, Separation, and Slope were found to separate the two groups at the .01 level of significance. Quast suggests that when these ten attributes appear in a child's record, "'neuronic' rather than neurotic etiology" should be considered.

1. Rotation Studies

A sizable portion of the research on the Bender-Gestalt has been devoted to attempting to ascertain the significance of rotations, with the majority of the studies probing its relation to cerebral dysfunction.

There is no standard criterion of what constitutes a rotation; on the contrary, there seem to be as many definitions as there are investigators. Griffith and Taylor (39) defined a rotation as "an angular displacement of 45 degrees or more in a figure which otherwise remained recognizable." Clawson (14) consider it "The revolving of the total figure on its axis in either a clockwise or counter-clockwise direction such that the angle subtended between the figure's horizontal axis and the horizontal

1 p.408.
2 p.189.
edge of the paper is more than 15 degrees greater than that in the standard stimulus figures.\textsuperscript{1} Billingslea's (10) criterion was "any declination from the normal axis",\textsuperscript{2} while Hanvik and Anderson's (44) criterion was 30 degrees or more. Hutt and Briskin (50) characterized rotations as: "(a) mild, in which case the axis is rotated approximately 5 to 15 degrees; (b) moderate, in which case the axis is rotated 15 to 80 degrees; and (c) severe, in which case the axis is rotated 80 to 180 degrees."\textsuperscript{3}

As there is no single criterion for a rotation, in like manner, there is no single interpretation or psychiatric category to which the phenomenon belongs. It may occur in the records of all clinical groups, although it is perhaps most frequently found in the protocols of psychotics, individuals suffering intracranial pathology and in the records of the mentally retarded.

Fabian (23), in an exhaustive study, investigated vertical rotations in visual-motor performance in children. As part of the research, he collected the protocols of 568 children and classified rotational tendencies at different age levels, concluding that in normal children, rotation from the horizontal to the vertical position is

\begin{itemize}
\item \textsuperscript{1} p.199.
\item \textsuperscript{2} p.14.
\item \textsuperscript{3} p.63.
\end{itemize}
a developmental phenomenon which disappears as the child matures, usually at about 7 or 8 years-of-age.

In agreement with Bender (7), he found that rotation is very common in pre-school and beginning school children. However, as the child progresses in school, the tendency becomes less pronounced. In one group of 217 children from seven and one-half to nine years of age, only about 7% rotated the figures and these were almost completely from the horizontal to the vertical direction. Rotations were found equally frequent in both sexes, although there was a slightly greater tendency in boys after eight years and in girls before that age. Fabian then presented the designs tachistoscopically, exposing them for five second intervals. He found that he obtained two to four times as many rotations in the protocols as when no time limit was imposed and that vertical rotations were overwhelmingly predominant. He concluded that the latent tendency to "verticalization" demonstrated itself in this experiment and supports his theory that vertical rotation is a persistent feature of visual motor functioning, which is simply inhibited with age.

Fabian theorizes that physiologically, the muscle mechanics of the arm contribute to verticalization in that the construction favors movements in the vertical direction. Psycho-physically, he seems to attribute the phenomenon to
a combination of the Law of Pragnanz and apparent movement. He completes his theories with internal forces or psychological factors partially based on body image, i.e., the projected internalized schemata of the concept of the child's own body image created from the care and affection the child has received from birth from external, upright figures. He maintains that although this is a developmental phenomenon, its persistence may be indicative of organic brain disease or mental deficiency.

In studies mentioned previously with exogenous and endogenous mentally retarded subjects, Halpin (40), using more than 90 degrees as his criterion for rotation, found no significant differences in the number of rotations between his groups, while Bensberg (8) found more rotations in his exogenous group.

In 1953, Hanvik (43), as the result of a study in which 20 children with abnormal EEG records rotated one or more figures in 80% of the protocols, made the following statement in the Journal of Clinical Psychology, "THERE IS UNDOUBTEDLY a high correlation between rotation of the Bender figures and electroencephalographic abnormalities. These preliminary findings would appear to justify the conclusion that the rotation of figures of the Bender-Gestalt Test is even more highly predictive of brain damage in children than has been found to be the case among adult

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1 Hanvik's capital letters.
In a recent study designed primarily to evaluate the Spiral Aftereffect Test as a predictor of normal and abnormal EEG records in children, Blau and Schaffer (11) included the Bender-Gestalt in their test battery, hypothesizing that as one of the tests it could discriminate children of essentially normal cortical function from those having disrupted cortical function. They developed a five-point rating scale for the Bender which they applied as a kind of "inspection technique" noting gross distortions such as collision, destruction of the gestalt, and rotations. They scored the total protocol from 0 to 4, with 0 representing essentially no gross deviations. "Predicted normal" scores were 0 and 1, while "predicted abnormal" were 2, 3, and 4. Their experimental group was composed of 46 children whose mean age was approximately 10 years and 2 months and whose EEGs were "predicted abnormal" on the basis of their scores on the Spiral Aftereffect Test. Their control group was composed of 20 children matched for age, whose EEGs were "predicted normal" on the basis of the same test. Both groups were selected from 420 cases examined at an outpatient psychological clinic. They found that the Bender-Gestalt used in this method correlated at the .01 level of confidence with both the EEG findings and the Spiral

1 p.399.
Aftereffect scores. In view of the small number chosen from the large number examined in producing the experimental group, it is suspected that the experimental group in this study was composed of children suffering severe neurological impairment rather than borderline cases. Thus the question arises of Blau and Schaffer's use of the term "screening devices" in referring to the psychological tests used, since the term "screening" usually implies the necessity of further evaluation.

In a very extensive and well-designed study, Hanvik et al. (45) selected a group of 108 children ranging in age from 7 through 14 years from among 150 who had been referred to a children's psychiatric clinic over an 18-month period. One half of the group, or 54 children, had abnormal EEGs, while the other half had normal EEGs. The decisions as to the normality or abnormality of the EEGs were made by two independent raters, who, in cases of initial disagreement, re-read the tracing together and then arrived at a joint decision. The children in the two groups were matched in respect to age, sex, socio-economic group, race, intelligence, and marital status of the parents. Although the primary aim of the study was to attempt to answer the question, "How well do the pediatrician, electroencephalographer and clinical psychologist agree on which children are to be called brain-injured children?", only the Bender-Gestalt

1 p.365.
findings are of interest to the present study.

From a battery composed of the Wechsler Intelligence Scale for Children, Bender-Gestalt Test, Porteus Mazes, Stanford-Binet Memory for Designs Test, Raven Progressive Matrices, Cerebral Dominance Test, and the Jastak Wide Range Reading Test, only the Coding subtest of the WISC and the Bender-Gestalt showed a significant difference between the abnormal EEG group and the normal EEG group. In the case of the Bender-Gestalt, this was obtained only by the subjective rating of the protocols by the Examiner and was significant only at the 5% level. The total score of the Pascal-Suttell method did not differentiate between the two groups. Three items, however, in their scoring system did differentiate: (a) the number of dots on Figure 3; (b) asymmetry of the curved portion of Figure 4; and (c) distortion of Figure 8. Highly relevant to Hanvik's 1953 paper was the finding of no differences in the frequency of rotation between the two groups. Hanvik et al. concluded that Pascal and Suttell's system of scoring the Bender-Gestalt is less predictive of EEG diagnosis than is a subjective system of Bender-Gestalt evaluation based on the psychologist's experience.

G. Conclusions

In general, the results of the investigations reviewed
in this section suggest that material can be gained from the Bender-Gestalt which, in some instances, could be used as leads to be followed up in ensuing clinical situations, i.e., further testing, interviews or therapy sessions. However, the studies are not in agreement that the Bender-Gestalt has value as a screening device to be used with some diagnostic categories or in individual cases.

It would seem that one of the few approaches to the Bender-Gestalt Test which has not been made, is that of quantifying it and allowing its weight to contribute to the total score of a larger test combination. It is in this method that part of the present research is utilizing the test.
Chapter 3.
THE SPIRAL AFTEREFFECT TEST

I. Early Studies which Lead to the Investigations of the Test as a Clinical Technique

A. Introduction

A subject fixating on a slowly revolving Archimedes Spiral (see Plate 2) ordinarily perceives the illusion that the spiral is contracting if it is revolving in a clockwise direction, or expanding if it is turning in a counter-clockwise direction. If, after an interval of exposure, the rotation is abruptly terminated, the ordinary person perceives an afterimage which is the reverse of that perceived while the spiral was in motion, i.e., expansion, if the spiral had been seen as contracting, or contraction, if the spiral had been seen as expanding.

The literature on the Spiral Aftereffect Test, or SAET as it will be referred to in this thesis, will be discussed in the following general order: early studies which instigated research, proposed theories attempting to explain the phenomenon, studies of the discriminative powers of the test in diagnosing cerebral dysfunction,\footnote{When the terms, "organicity", "brain damage", "cortical involvement", "cortical damage", or similar labels are used in the text, they are the terminology of the author of the specific paper under discussion.} studies of the variables which may influence the test,
and studies of the use of the test in conjunction with other tests.

Although Freeman and Josey (25) and, later, Standlee (98) conducted the early studies that indirectly lead to the investigation of the SAET as a diagnostic technique for brain damage, Plateau, a hundred years earlier (1850), had investigated the phenomenon. Through his early experiments he discovered that clockwise and counter-clockwise rotations, upon ceasing, produced the opposite illusions, and that there were individual differences in the ability to perceive the afterimage.

B. Freeman and Josey

Freeman and Josey (25), working in the area of mental deterioration, noted that psychotics differed from normals in their ability to perceive the spiral aftereffect, which they attributed to memory impairment in the psychotics. They conducted an investigation using an ill-assorted group of psychotics both in age and diagnoses and a normal group of high school and college students. They theorized that the inability to perceive the aftereffect was an indication of memory impairment, the degree of which was estimated for each subject in the experimental group by the hospital staff. They then compared the SAET scores with the clinical
estimate of memory impairment. Although the data was not treated statistically, Freeman and Josey concluded that there was a strong probability that there was a correlation between inability to perceive the spiral aftereffect and memory impairment.

The authors confounded their results before they started by mixing cerebral dysfunction and functional psychoses. Their experimental group included schizophrenia, manic-depressive psychoses, dementia paralytica, cerebral sclerosis, epilepsy, and Korsakoff's syndrome. Further, no consideration was given to intelligence and no attempt was made to control age factors. The experimental group ranged from 19 to 76 years, while the normal group ranged from 8 to 65 years.

C. Standlee

Standlee (98) sought a relationship between the spiral aftereffect and memory ability, which he assumed Freeman and Josey had been attempting to measure, rather than memory impairment. He utilized the Wechsler Memory Scale as an objective index of memory ability and, together with this, gave each subject two trials on the SAET, one exposure clockwise and one exposure counter-clockwise. His groups consisted of twenty-five "psychotics" and sixteen "normals".

All of the normals perceived the aftereffects of
both contraction and expansion, while twenty-three of the psychotics were also successful on both trials. Standlee then readministered the same two tests to his psychotic group eight hours following electroshock and found that neither the ability to perceive the aftereffect nor the scores on the memory scale were impaired. He concluded that there was no relationship between memory ability and the ability to perceive the aftereffect, since the combined scores on the Memory Scale ranged from the lower to the upper limits and subjects at the lower end made perfect scores on the SAET although their memory ability was poor. He also concluded that electroshock does not impair the ability to perceive the negative aftereffect.

Unfortunately, Standlee provided no information about his subjects, apparatus or strength of shock, which makes the results difficult to evaluate. The effect of EST cannot be estimated without some indication of the number of treatments, if any, his subjects had received previously. Standlee agreed that he confounded his results by introducing practice effect in administering the Wechsler Memory Scale to his experimental group both before and following shock.

II. Theoretical Background

In the majority of the studies of the use of the SAET as a diagnostic technique, relatively little space
has been devoted to the theoretical underpinnings of the phenomenon of the negative aftereffect. However, studies in apparent motion have contributed some theories which may be applicable, while some investigators have ventured other than physiological explanations.

Wertheimer (118) explained the phenomenon of apparent motion in normals as irradiation of excitatory effects arising from the site of the stimulation. If the initial stimulation is followed by stimulation in another part of the brain, the irradiation produced by the second combines with the first to produce the apparent motion.

Teuber and Bender (111) and Pavlov (74) hypothesized that lesions or damage to the brain have the effect of decreasing the excitatory effects in the damaged area, and as a result, inhibiting the perception of apparent movement. Shapiro (92), using these two hypotheses, postulated that in brain-damaged patients, the increased inhibitory effects weakened or destroyed the ability to perceive the apparent motion.

Price and Deabler (78) claimed that they demonstrated that the perception of the negative aftereffect is a cortical phenomenon rather than retinal, by having subjects view the rotating spiral with one eye covered. Upon cessation of the rotation the subjects were instructed to remove the cover from the first eye and to place it
over the eye with which they had been viewing the rotating spiral. It was found that the negative afterimage then occurred in the second eye, i.e., the eye that had been covered while the spiral was rotating. But Day (21) claims that this apparent interocular transfer is not necessarily evidence of cortical locus.

Saucer (85, 86) based his theory on isomorphism, i.e., that perceptual organization is based on a matrix synthesis of perceptual organizations related to stimulus detail as well as to the temporal aspects of the configuration of the stimulus. Thus the ability to perceive the negative afterimage is dependent upon the functional efficiency of the cerebral cortex. When this integrating or synthesizing process is impaired or damaged, the afterimage will not be perceived. Saucer and Deabler (87) take this a step further and expand the matrix theory to include the entire cerebral cortex. They assume that perception is global, and thus damage to any portion of the cerebral cortex lowers the efficiency of the matrix, resulting in lowered capacity to perceive the afterimage.

Eysenck (22) considers a stimulus-response connection to be excitatory. Whenever this occurs, simultaneously a reaction takes place in the nervous structure opposing its re-occurrence. This is considered inhibitory. There are individual differences in the degree and intensity of
both excitation and inhibition. According to his satiation theory, cortico-neuro events produce inhibition which stops the negative afterimages. He claims that the amount of inhibition produced could be estimated by the position of the subject on the extraversion-introversion continuum of the Maudsley Personality Inventory.

Location and type of brain damage have also been raised as questions in relation to the ability to perceive the negative aftereffect. Gallese (26) found that alcoholics and convulsives tend to perform like non-organics, while Page et al. (72) found that their prefrontal lobotomy cases also resembled non-organics.

Holland and Beech (48) suggested that the shorter duration of aftereffect in organic patients may be due to difficulty in maintaining fixation. They further theorized that patients with injuries categorized as "multiple" or "diffuse" might have more difficulty in perceiving the aftereffect than those with localized lesions. Day (21) also proposed that weakness of the aftereffect or the inability to perceive it are due to difficulty in fixating, which has often been attributed to distractibility. He pointed out that in demonstrations of cortical integration of ocular movements, some organics had difficulty in maintaining focus, in that their eyes involuntarily followed a moving object. In contrast to Holland and
Beech, he opined that patients suffering damage to centres controlling voluntary fixation would probably have the greatest difficulty in perceiving the afterimage. Since these centres are in the frontal regions, he believes that damage in that area would most seriously affect the perception of the aftereffect.

Several investigators (26, 1, 94, 88) have questioned whether the organic's apparent inability to perceive the afterimage may not be due to their inability to verbalize changes in ambiguous stimuli as Goldstein and Scheerer (34) suggest, rather than failure to perceive the afterimage.

Finally, Sindberg (94) suggests that it is unreasonable to expect that brain damage per se should affect the ability to perceive the aftereffect in the same way with each individual. He believes that areas of the brain involved in organizing and transmitting sensory information to the consciousness are as important as the neural chains from the retina to the visual cortex. Thus, damage to large areas of the cortex would interfere with perception of the afterimage more than mild focal damage.

Although few of these hypotheses agree, they all seem to arise from and respond to the rather general conclusion that when groups are compared, fewer individuals suffering cerebral dysfunction perceive the negative afterimage than those free from impairment. The research which
led to the latter conclusion follows this section.

III. Studies of the Use of the SAET in the Diagnosis of Organicity

A. Price and Deabler

In 1965, Price and Deabler (78), following the lead of Freeman and Josey's findings, hypothesized that organic patients, particularly those with cortical involvement, would be unable to perceive the afterimage or less able to perceive it than normals.

Their experimental groups consisted of forty non-organic psychiatric patients, none of whom was undergoing electroconvulsive treatment at the time of the study, and one hundred and twenty organic cases with known cortical involvement. All subjects used in the study were adult males.

A 6-inch disc rotating at 100 rpm was used. Half of the subjects were administered four trials of 30 seconds each on the SAET in the order ABAB, while the remainder were tested in the order BABA.

Price and Deabler obtained a chi-square for their data significant at the .001 level between the organics and non-organics and no significant difference between the functional psychiatrics and the normals. Only 2% of their organic group perceived the aftereffect on all four
trials. They concluded "Organic cases with cortical involvement can be differentiated from nonorganic with high degree of certainty by means of the spiral after-effect technique."¹

Again little information was given about the experimental groups other than that the normal group was composed of adult males. Thus one questions, particularly in the organic group, adequacy of vision, ages, intelligence, general physical condition and degree of orientation. Domiciliary Units in Veterans' Administration hospitals house many men well into their eighties, which offers the possibility of a gross discrepancy in ages existing between the groups. Further, one questions the generalization from these results that "When failure to perceive the aftereffect is found, it is almost certain that cortical involvement exists."²

B. Gallese

Following Price and Deabler's study, Gallese (26) attempted to validate the usefulness of the SAET in detecting brain damage. His apparatus consisted of 6-inch discs, A clockwise and B counter-clockwise, rotated at 90 rpm. Order of presentation was ABAB. His procedure differed from Price and Deabler's in that when a subject gave an unsatisfactory response, he questioned the patient

¹ p.302.
² p.301.
directly: "Does it seem to be getting bigger or smaller, or going away from you or coming toward you, or anything else?"¹

The composition of Gallese's groups was as follows: 30 normal hospital employees, 41 schizophrenics, 97 patients diagnosed as acute or chronic brain syndrome, and 12 lobotomized schizophrenics. He further subdivided his organic group into A, all diagnoses other than alcoholic and convulsive disorders, and B, alcoholic and convulsive disorders. Gallese obtained highly significant differences between his groups (p < .0005) and no differences between the normals and schizophrenics (p > .30). None of the lobotomized patients received organic scores. Using a score of 1 for each trial, with a score of 4 for all correct responses, Gallese employed a cutting score between 2 and 3, considering all scores of 2 or below as organic. However, in the analysis of correct versus incorrect classification, 54% of his total organic group were misclassified, although only 3% of the nonorganic group were classified incorrectly. In discussing the misclassification, Gallese suggested that where organic scores were obtained, they almost always indicate organicity, although the reverse is not always true.

Among his conclusions was that the SAET is more

¹ p.255.
sensitive to some types of organicity than to others, the alcoholics and convulsives tending to score more like monorganics. Also, the SAET is unrelated to age, sex or length of hospitalization. He offered no statistical evidence in support of the latter.

C. Page, Rakita, Kaplan and Smith

Page et al. (72) attempted to improve upon the previous studies by using a control group of functional psychiatric patients carefully matched with their organic group for age, education and length of hospitalization. Their groups numbered only 20 subjects in each.

They used an 8-inch disc rotated at 100 rpm, of spiral A (clockwise) only, with which they administered 3 trials to each subject. Duration of the aftereffect was recorded for each trial.

The results indicated that the duration of the aftereffect, as reported by the subjects, was not able to differentiate between the two groups, nor was there a significant relationship between the controlled variables of age, education, and length of hospitalization and duration of aftereffect. Although the SAET scores provided significant differences between the groups, when Page et al. considered their results on an all-or-none basis, i.e., the effect was either reported or not reported, they concluded that 40% of their organics would not have been
identified, and 15% of the functional group would have been incorrectly identified as suffering cerebral dysfunction. They further concluded that although their results support Price and Deabler's theoretical implications, the findings also suggest caution in using the SAET as a diagnostic technique.

D. Stilson, Gynther and Gertz

Stilson, Gynther and Gertz (100), in a paper discussing research findings on the SAET and base rates in U.S. mental hospitals, i.e., the percentage of incorrect diagnoses in a certain psychiatric category which would be made if all patients were given the same diagnosis upon admission to a mental hospital, concluded that the SAET "apparently can be used with considerable confidence to diagnose NON-ORGANICS."1 They further suggested that this emphasizes the need for the SAET to be used in conjunction with a test having high sensitivity for organics.

E. Gilberstadt, Schein and Rosen

Gilberstadt, Schein and Rosen (29), in a replication study of Price and Deabler's, tested 87 consecutive testable admissions to a psychiatric service and 140 consecutive testable admissions to the neurology service of a Veterans' Administration Hospital. The tests were administered on an average of 5 days after admission,

1 p.437.
following the procedure used by Price and Deabler.

The authors pointed out that although Price and Deabler used the terms "organic", "brain damage" and "cortical", they were sure that Price and Deabler meant cortical. Thus, thirty cases were picked as suffering cortical damage by the neurology staff from the entire group that had been tested. The results of the scores of the thirty cortical cases were then compared with base rates, and it was concluded that when the total experimental population was considered, the SAET did not improve upon the base rates. In contrast, they claimed that base rates correctly identified 84% of the sample, while the SAET correctly identified 83.4% when a cutting score of between 0 and 1 was used. Gilberstadt et al. concluded that the SAET has limited clinical usefulness.

F. Berger, Everson, Rutledge and Koskoff

Berger et al. (9) made an attempt to cross-validate Price and Deabler's statement, "While adequate explanation of the phenomenon remains to be hypothesized and verified, the results are such as to justify present clinical use of this technique in diagnosis of organicity."¹ In addition, they investigated the effect of the direction of the spiral on difficulty and duration of aftereffect.

¹ (78) p.302.
the relation between vision and the ability to perceive the aftereffect, and the relation between SAET scores and indices of neurological damage.

Their subjects were 110 patients admitted in a three-month period to a neurological ward of a Veterans' Administration Hospital. Their apparatus was by then the rather standard equipment; i.e., 6-inch discs, A and B rotated at 78 rpm and presented 8 feet in distance at eye level from the subject.

Two examiners were used, the first to discuss the procedure with the subject and to record, and the second to adjust the apparatus. Each patient's vision was tested with a Snellen Chart followed by 4 trials on the SAET. Berger et al. randomized the presentation of spiral A and spiral B by presenting them in varied order to each block of six patients as follows: ABAB, ABBA, ABBB, BBAA, BABA and BAAB. Questions were used to determine the presence or absence of the aftereffect and each subject who scored 3 out of the possible 4 trials was classified as a "Seer", while subjects who failed 2 or more trials were classified as "Nonseers". Of the 110 patients examined, 31 were classified as "Nonseers".

When the results between the two groups were compared, a significant difference in visual acuity \( p < .01 \) was obtained, although age was not found to be a factor. Significant differences \( p < .01 \) were also obtained
between spiral A and spiral B, indicating that spiral B (expanding aftereffect) was less difficult and had a longer duration of the aftereffect than spiral A. However, only "Seers" were used in this portion of the study.

Finally, Berger et al. found no significant relationship between performance on the SAET and EEG results, pneumoencephalographic studies or skull X-ray reports. However, they claimed a relationship (p < .05) between the SAET and visual field studies, spinal fluid examinations and global judgments of the presence or absence of brain damage. They concluded that caution should be exercised in the use of the SAET for individual diagnostic purposes.

One questions the results of this study in that functional psychiatrics were included among the neurologicals thereby introducing additional variables. In addition, subjects who were able to perceive the aftereffect 50% of time were considered "Nonseers". It is possible that significant relationships would have been obtained with the other neurological indices if "Nonseers" had been classified as subjects who were not able to perceive the aftereffect at any time.

G. Goldberg and Smith

In still another follow-up study, Goldberg and Smith (32) included the SAET as part of their test battery in examining patients referred for psychodiagnostic
evaluations in a Veterans' Administration Hospital for a period of one year.

They used 10-inch spirals, A and B, rotated at 78 rpm, and essentially the same procedure and scoring as used by Price and Deabler. Each patient was exposed to four trials in the order ABBA. The authors divided their subjects into four groups; organics, psychiatrics following four or more electro-shock treatments, psychiatric patients not having undergone EST, and a normal control group composed of professional staff and students at the hospital. The organic group ranged from suspected mild generalized cerebral dysfunction to gross impairment.

Although they obtained highly significant differences between the normal group and the combined patient groups (p < .001), there were no significant differences when the experimental groups were adjusted for age and compared with each other. However, the psychiatrics performed more effectively than the post-EST patients, and the organics the least effectively of the three groups. No relationship was found between intelligence and the SAET.

Goldberg and Smith again warned against the indiscriminate use of the technique in differential diagnosis.

H. Holland and Beech

Holland and Beech (48) further investigated the relation between the failure to perceive the negative
aftereffect and organicity. Their subjects consisted of twenty-one brain damaged patients and seventeen student controls. They claimed that their procedure was similar to that of Price and Deabler's. However, their experimental group was given 4 trials of 30 seconds duration, 2 clockwise and 2 counter-clockwise, while their normals received 2 trials, the first of 15 seconds duration and the second of 30 seconds duration. The authors did not mention the direction of the rotation for their normal group. The two groups were then compared on the basis of trial number two, which seemed to be the only test that was common to both groups.

Although the inability to perceive the negative afterimage failed to distinguish between the two groups, Holland and Beech found that the duration of the aftereffect was significant at the .001 level, the organic group perceiving the afterimage for the shorter period of time. They concluded that the SAET might be useful in diagnosing brain damage if scored for duration of afterimage.

I. McDonough

McDonough (64) tested the hypothesis that process schizophrenia is cortical in nature by employing the Critical Flicker Frequency and the SAET with four groups of subjects; 20 organics with known brain damage, 20 process schizophrenics, 20 reactive schizophrenics, and
20 normals. Since the Critical Flicker Frequency findings are not directly related to this thesis, they will not be discussed.

McDonough used an 8-inch spiral rotated at 100 rpm, situated at a distance of 8 ft. from the subject. His instructions were Gallese's (26), which include questioning the subject while labelling the phenomena. He gave four 30-second trials with Spiral A in which the spiral seemed to contract while rotating and to expand when stopped.

All the subjects in the Process, Reactive and Normal Groups, and eleven of the subjects in the Organic Group received perfect scores. Only five of the organics were unable to perceive the aftereffect on any of the four trials.

McDonough concluded that since the SAET failed to identify 45% of his group suffering known brain damage, it would be of little use in a clinical setting which would require more stringent discriminative ability.

IV. Studies of Variables Influencing the SAET

A. Harding, Glassman and Helz (Maturation)

Harding, Glassman and Helz (46) tested 81 children ranging in age from 48 to 71 months to investigate the effects of maturation on the ability to perceive the spiral aftereffect. They used two 6-inch discs rotated at 78 rpm. Prior to testing, efforts were made to gain
rapport and to induce a set of looking for relative sizes. The latter was achieved by having the child point out the largest and smallest circles in a series of sizes. Further efforts were made to help each child to communicate his perceptions including labelling, i.e., "Does it get bigger or smaller?" Each child was administered four trials, with three correct responses out of the possible four, considered as success. Failures were re-examined after an interval of about two weeks to assure that they were due to the inability to perceive the afterimage rather than to other variables.

Although Harding, Glassman and Helz did not treat their data statistically, they found that the youngest child to perceive the aftereffect was 55 months, while all children beyond the 69th month were successful. They also found that the mental age was a better indicator of ability to perceive the aftereffect than the chronological age, since there was less overlap when the children were classified in this manner.

They concluded that the inability to perceive the after-effect below a certain chronological age level was presumably because of insufficient neural maturation, which in this incidence created behaviour similar to that of brain-damaged adults.
B. Aaronson (Age, Intelligence, Aphasia)

Aaronson (1) used an epileptic population with a high incidence of mental retardation to investigate the effects of age, intelligence, anomia, laterality of sensory disorders and extent of disorder in sensory perception on the SAET. His groups contained both males and females ranging in age from 8 to 70. His apparatus was a replica of Price and Deabler's, although rotation speed was 78 rpm. He used Gallese's (26) method of administration and scoring, i.e., more help was given to the subjects in verbalizing their perceptions. I.Q.s were obtained by administering the Wechsler-Bellevue I to forty patients, while fifty were given an aphasia screening test. The latter included tests for impairment of visual, auditory and tactual receptive functions.

No relationship was obtained between age and scores on the SAET. However, poorer scores were associated with the majority of the other factors tested; lower I.Q.s, anomia, visual and auditory impairment and the impairment of a number of sensory avenues, including right-sided sensory impairment. Thus Aaronson felt that his data supported the validity of the SAET as a measure of brain damage. However, he questioned how much the inability to verbalize has in concealing perceptions of the organic scorers.
C. Schein (Duration of Afterimage)

Holland and Beech (48) had found that duration of the negative aftereffect was significantly shorter in their organic group than in their normal group. In incidental observations in their studies, Spivak and Levine (96) reported that their brain-damaged group reported longer durations of the negative aftereffects than their controls, and Page et al. (72) found no difference in the duration between their brain-damaged and their schizophrenic groups. Hence Schein (88) focused his study on the duration of the negative afterimage.

His groups were composed of admissions to the neurology and psychiatry services of a Veterans' Administration Hospital, divided into Organic, Psychiatric and Normal groups. The Organic Group was further subdivided into cortical and subcortical damage, while the Psychiatric Group was subdivided into neurotics and psychotics. Schein's apparatus included a large orange block and a black circle mounted on a white background which were used as projection devices for the negative afterimage. If the subject was able to perceive the negative afterimage in two consecutive pretrials out of six, eight trials followed in which the duration of the afterimage was measured. However, only those subjects who reported five or more afterimages in the eight measured trials were used
in the statistical analysis.

Schein found that the duration of the afterimage was not related to diagnosis, intelligence or drugs. However, the inability to perceive the afterimage did separate the brain-damaged group from the other two groups at a highly significant level. Since only 7 of his 123 subjects failed to perceive the afterimage in two consecutive pretrials, Schein suggested that failure on the SAET by brain-damaged patients may be due to confusion over the procedure rather than their inability to perceive the aftereffect.

D. Sindberg (Stimulus Variation)

The variables of speed of rotation and length of exposure time were studied by Sindberg (94). His subjects were fifty patients with demonstrable cortical damage, fifty psychiatric patients without suspected cortical damage and fifty college students used as controls. His apparatus was a 7-inch disc which could be rotated at variable speeds from 18 to 90 rpm as well as reversed. Another departure from the usual form of administering the SAET, was that the disc was placed slightly below eye level at a distance of 6 feet rather than 8 feet. The patients were told that they were to watch for expansion, contraction or changes in depth or distance. Each subject was given 10 trials in fixed order, with the first 8
presenting all combinations of 18 and 54 rpm, clockwise and counter-clockwise rotations, and 10 and 30 second exposure times. The 9th and 10th trials were clockwise and counter-clockwise at 90 rpm.

Results indicated that both shortening of exposure time and decreasing the speed of rotation made the negative aftereffect more difficult to perceive. Length of exposure time was found to be the most significant variable. Direction of rotation was significant for only the non-organic groups. Sindberg suggested that it was so difficult for the brain-damaged subject to perceive the negative aftereffect under optimal conditions that the additional difficulty of change in direction had little effect. He concluded that conditions of medium difficulty discriminated best between his experimental groups and that conditions approximating those of former studies, which he seemed to estimate as 90 rpm with a 30-second exposure, discriminated less well.

E. Whitmyre and Kurtzke (Duration of Stimulus)

Whitmyre and Kurtzke (120) tested two variables which could influence the SART, mentation deficit and duration of exposure to the rotating disc. They defined mentation defect as "the presence of impaired memory, orientation, judgment, intelligence, or emotional control caused by
or associated with brain tissue damage, such impaired function having been evaluated by ordinary clinical neurological examination."¹ They used three groups of 20 subjects each, a schizophrenic group, a group of organic subjects free from mentation defects and an organic group with mentation defects. The SAET was administered at 78 rpm at a distance of eight feet. No material was given on the directions used. Exposure times were 10", 20", 30", 40" and 50" with each subject receiving four trials at each exposure.

Whitmyre and Kurtzke in confirmation to Sindberg (94) found that there was no significant difference in the number of subjects perceiving the aftereffect at any of the exposure times. However, the Mentation Group failed to perceive the aftereffect significantly more often than the subjects in the other two groups. No difference was obtained between the organics without mentation deficit and the schizophrenics. Their conclusion was that organic patients with mentation defects are less likely to perceive the aftereffect than organics without mentation defects.

In considering the finding of no difference between their organic without mentation and their schizophrenic groups, it would seem that the fact that their schizophrenic group had undergone intensive insulin and/or

¹ p.119.
electroshock therapy should be considered in evaluating this finding.

V. Studies of the Use of the SAET in Conjunction with other Tests.

A. Garrett, Price and Deabler (Memory-for-Designs)

Garrett, Price and Deabler (27), in an attempt to increase the range as well as the validity and reliability of their technique of diagnosing cortical damage, employed the Kendall Memory-for-Designs Test with the SAET. Their experimental group of forty organics, all with known cortical brain involvement, ranged in age from 44 to 84 years. Their thirty controls drawn from professional hospital staff, ranged from 20 to 54 years. Unfortunately, the authors did not treat their data statistically and their paper seems more anecdotal than experimental. However, they claimed that where one test failed to agree with the established diagnosis, the other test "revealed the impairment, so that practically all of the cases studied were accurately evaluated by the battery."¹ They concluded that the combination of the two tests resulted in a highly valid battery for the diagnosis of cortical involvement.

B. Price, Garrett, Hardy and Hall (Memory-for-Designs, Binaural Beats)

In a follow-up study, Price et al. (79) added an

¹ pp.224-225.
auditory test to the battery of the SAET and the Memory-for-Designs test. They hypothesized that perception of a "beat phenomenon" was also a part of the cortex's higher integrative function and, as such, its perception would be impaired in brain-damaged subjects. Their groups were 50 organics and 50 normals at a Veterans' Administration Hospital. Each subject was administered the Memory-for-Designs, the SAET, and then tested for perception of the auditory beat. The latter was done with Audio Frequency Oscillators. The subject, wearing earphones, was presented a constant tone of 250 cps in one ear, while simultaneously in the other ear the range was slowly lowered from 300 to 200 cps and then slowly raised again. Both ears were tested in this fashion, with the subject reporting changes in steadiness or smoothness of tone.

Price et al. found that a t-test of the differences between the two groups on the binaural beat was significant at the .01 level of confidence. Their data further indicated that the Memory-for-Designs accurately diagnosed 88% of the cases, the SAET 84% and the Binaural Beats test 76%. The combination of the three tests was able to identify 96% of the cases. They concluded that they had again increased the validity and reliability of the diagnosis of cortical impairment.
C. Sappenfield and Ripke (Retinal Rivalry, Stereoscopic Figure-Tracing)

Sappenfield and Ripke (84) compared the effectiveness of the Retinal Rivalry Test and the Stereoscopic Figure-Tracing Test with the SAET in differentiating organics, schizophrenics and normals. There were 30 subjects in each group.

They used three 8-inch spirals, A, B and C. Spirals A and C appeared to expand while rotating and produced the aftereffect of contraction, while spiral B appeared to contract with the aftereffect of expansion. The spirals were administered in ABC order, followed by the Retinal Rivalry and Stereoscopic figure-tracing tests.

The results indicated that each test, as well as each subtest, discriminated significantly between the organics and normals, while the total scores of each test were able to discriminate between organics and schizophrenics. However, the only subtest that could effectively discriminate between the organics and the schizophrenics was the SAET spiral producing the negative aftereffect of expansion.

The Retinal Rivalry test was the only test to make a significant differentiation between the schizophrenics and normals. This test also produced more correct classifications in each group than either the Figure-tracing or the SAET.
D. Spivak and Levine (Neckar Cube, Reversible Contours)

Spivak and Levine (96) used 32 brain-damaged and 35 emotionally disturbed adolescent boys to investigate the relation between the SAET and reversals on the Neckar Cube and Reversible Contours. Included in their battery was the memory test from Year 10, Form L of the Revised Stanford Binet, which was read to each subject before the tests were administered with the recall following the SAET, Neckar and Reversible contours. Only spiral A of the SAET was used.

They obtained no relationship between the SAET and performance on the reversible figures, nor between the SAET and memory loss. Although there was a significant difference in ability to perceive the afterimage between the two groups, a controversial finding was that the duration of the afterimage for the Brain-damaged Group was significantly longer than for the Emotionally Distrubed Group.

This study is difficult to evaluate and to compare with other studies since only spiral A was used for 5 consecutive trials with instructions and demonstrations to the point of telling the subject what was expected. Thus, it would seem that the findings in both groups should be treated rather cautiously. A control group of normal adolescents would have been a helpful addition to the study.
E. Davids, Goldenberg and Laufer (The Trail Making Test)

Davids, Goldenberg and Laufer (20) used the Trail Making test in conjunction with the SAET in an investigation of the ability of the two tests to discriminate between emotionally disturbed children and children with known cortical damage. All subjects in the study were ten-year-olds and of normal intelligence. Their three groups consisted of 15 cerebral palsied children with known cortical damage, 29 emotionally disturbed children and 24 normal children.

Six trials on the SAET were administered using spiral A and spiral B. Information was not given about the apparatus other than that it was similar to Price and Deabler's (78). The SAET was followed by Reitan's version of the TMT. This adaptation, together with findings relating to the TMT will be discussed in the section on the TMT.

Davids et al. found that when the three groups were combined, there was a significant (p < .01) degree of association between Part B of the TMT and the ability to perceive the spiral aftereffect. No significance was found between intelligence and spiral scores in any of the groups. The authors concluded that the results of earlier investigations using adults for subjects could be
extended to children with organic impairment and that both tests offer considerable potentiality for diagnosing brain damage in children.

F. Blau and Schaffer (Draw-A-Man, Bender-Gestalt, WISC subtests)

The final study in this group is that of Blau and Schaffer (11) who evaluated the SAET as a predictor of normal or abnormal electroencephalographic records in children.

They employed an 8-inch, reversible disc, rotated at 80 rpm with which they administered eight trials in the order ABBABBA to each child referred to an outpatient children's clinic. The experimental group, chosen on the basis of the SAET scores, were 46 children who did not perceive the afterimage in five out of eight trials. Their EEGs were predicted abnormal. A control group of 20 children, matched for age and school placement, were selected on the basis of having obtained an eight, or perfect score on the SAET. This group was predicted to have normal EEGs.

In addition to the SAET, each subject was administered the Bender-Gestalt test, which was scored by an inspection technique based on a 5 point rating scale, the Draw-A-Man test, which was scored on the variable of tipping from the perpendicular, and several subtests of the WISC, for which the weighted scores were used.
The authors were careful to state that they considered the EEG an intermediate criterion rather than an ultimate criterion of brain damage, although they consider it an objective neurological examination. Thus, each child was given a 2 hour EEG examination and those cases which showed anomalies were placed in the Abnormal EEG Group, while those with no findings were considered to have normal cortical function.

The results indicated that the SAET had the highest correlation with the EEG criterion, while significant intercorrelations were obtained between the SAET and the Bender-Gestalt, the Draw-A-Man, and the Digit Symbol and Arithmetic subtests of the WISC.

The authors concluded that when a clinical psychologist is called upon to decide which children should be referred for neurological examinations, the SAET, probably in combination with other psychological tests, would be the best available technique for making the decision.

VI. Comments

In considering the investigations into the use of the SAET which have been described in this section, several comments seem appropriate.

The apparatus used in these studies has been different in every instance due to the fact that of necessity, the investigator has had to construct his own apparatus.
Although there has often been intentional variation in sizes of spirals, speed of rotation, and order of presentation, nevertheless, where replication studies have been attempted, the equipment has still varied from the original. Thus, uncontrolled variables were operating in all of these studies when one is attempting to compare them.

It would seem that many of the differences in the claims about the usefulness of the SAET can be attributed to differences in opinions as to what constituted brain damage in the studies. Further, the organic groups have often been composed of mixed categories of cerebral dysfunction and severity of impairment which confounded rather than elucidated the interpretation of the results. This has also been a problem with the present study. Long range studies of pooled test data with follow-up autopsy reports on specific areas of the brain would possibly help to clarify what the results are indicating. Such patients are available, for example, in mental hospitals, prisons and such places as U.S.A. Veterans' Administration Hospitals.

In relation to the present study, it is of interest that although the SAET has been used as part of a battery with other tests, the results in each study have been evaluated in a parallel fashion, i.e., the tests have only been compared with each other in their ability to discriminate between the experimental and control groups.
No attempt has been made to extract the parts of the various tests which have been able to discriminate at a significant level, and then to combine them into a single servicable unit for use as a screening tool. It would seem, in considering the lack of agreement as to the effectiveness of the test, that this is the role in which the SAET could be utilized, since it has not been generally demonstrated that it is effective enough as a screening technique to stand alone.
Chapter 4
THE TRAIL MAKING TEST

I. The Origin of the TMT

A. The Army Individual Test

The Trail Making Test, which will be referred to as the TMT in this thesis, is one of six tests which make up the Army Individual Test (65). The Army Individual Test (65) is composed of a battery of three verbal tests: Story Memory, Similarities-Differences, and Digit Span; and three performance tests: Shoulder Patch, Trail Making and Block Assembly. The tests were constructed in response to the need of training units and replacement centres for a test that could be used to back up recommendations for discharge under the provisions of Section VIII (Neuro-psychiatric). In addition, hospitals and neuropsychiatric units had requested an individual test that could be used together with other clinical techniques in psychiatric diagnosis.

Thus, the construction of the Individual Test was specifically designed for the use of the U.S. Army and was validated on the Army General Classification Test. It was standardized on a group of 1000 soldiers, chosen as representative of the total army population, with respect to their scores on the General Classification Test.
The test was designed to be brief, to be meaningful rather than ridiculous to the soldier, and to have a minimum of dependence on education and verbal ability. The Army Individual Test was provided for use of selected army personnel in 1944, on a restricted basis. The test yielded standard scores, with the TMT only contributing to the performance subscore. The TMT, as it was originally used in the Army battery, is described in the following paragraphs.

Part A of the TMT consists of 25 circles each containing in its centre a number from 1 to 25. The circles are placed at random on a single sheet of paper. The word 'Begin' is printed above circle number 1, and the word 'End' is printed above circle number 25. On the reverse side of the paper, on which Part A is printed, is Sample A. Before Part A is administered, the Subject is shown the sample containing 8 circles numbered from 1 to 8, with number 1 marked, 'Begin' and number 8 marked 'End'. The Examiner demonstrates by pointing to each circle through number 4 what he wishes the Subject to do, i.e., "Begin at number 1 (points to 1) and draw a line from 1 to 2 (points at 2) etc. until you reach the end." (pointing to circle marked 'End'). If the Subject makes a mistake, he is told by the Examiner exactly what the mistake is, "You started with the wrong circle....You
skipped this circle", or, "You should have gone to the circle marked, 'End'." If the Subject cannot complete the sample trail, the Examiner takes his hand and guides his pencil through the trail. The Subject is then told to repeat the sample. If he does not succeed, the Examiner again helps him to negotiate the trail. If the Subject again fails after the Examiner's second direct attempt to help, the Examiner discontinues the TMT and continues with the next subtest.

Part B, with sample B on the reverse side of the paper, consists of 25 circles with 13 of them labelled 1 to 13 and 12 of them labelled A to L. As in Part A, the Subject is directed to join the circles in ascending sequence alternating between numbers and letters, starting with the lowest number (1), and going to the first letter (A) and so on until the last letter (L) and the highest number (13) are reached. In Part B also, number 1 is marked, 'Begin' and number 13 is marked, 'End'. Again a sample, consisting of 4 letters and 4 numbers, is used before Part B is embarked upon. The procedure with the sample for Part B is similar to that used in Part A.

In both Part A and Part B the score is based on the time in seconds necessary to complete the test. If the subject makes an error (connects the wrong circles or
omits a circle) and corrects it before he has continued 3 circles beyond the origin of the error, it is not penalized. However, if the subject continues to 3 circles beyond, without discovering or correcting the error, the test is discontinued. If no errors are made, or errors are made and quickly corrected, the score is the time in seconds necessary for completion, with 20 seconds or below receiving the maximum 10 credits.

As used in this, its original form, the TMT is a speed test and after the samples are completed, the subject is instructed, "Draw the lines as fast as you can. Ready! Begin!" \(^1\)

II. Evaluations of the TMT in Surveys of Tests of Organicity

A. Armitage

Armitage (3) was one of the first to recognize the possibilities of the TMT, although it was published as a separate test in 1949 by Partington and Leiter\(^2\) under the name of the Partington Pathways Test. Armitage evaluated it as a test of organicity at the same time he evaluated Memory tests, the Patch Test, the Goldstein-Scheerer Cube test and the Stanford-Binet Vocabulary test. He set up the criteria that he believed should be fulfilled

\(^1\) p.29.
\(^2\) To date, every effort to obtain a copy of this test has met with failure.
by any screening device of organic impairment and then evaluated the tests mentioned in their ability to meet the criteria. Briefly, his criteria were as follows; the test must be short, interesting, easy and understandable; it should sample those functions that seem to suffer most as a result of brain injury and be relatively unaffected by neurotic trends; it should have a minimum of dependence on previously learned material, include performance items, and have validity and reliability. Finally, it should be of such a nature that it could be accomplished by gross muscular movements.

His groups consisted of 44 patients with known cerebral damage which he categorized as 9 focal, 17 focal-diffuse, and 18 diffuse. The severity and types of injuries were adjudged by a neurologist to range from severe to mild. All had received their injuries at least six months prior to testing. His control group consisted of 45 normal hospital employees and 16 patients with mild affective states.

The TMT was included in Armitage's group to be evaluated because it requires that the subject has the capacity to perceive a double relationship, to plan ahead, and to "shift". Further, the test is so designed that it may evoke perseveration. He pointed out in speaking of the carry-over effect from Part A (only numbers) to Part
B (numbers and letters), "If the Subject is rigid, perseverative, or unable to shift, it is easy to envision the difficulty that will be involved."¹

He altered the procedure in administering the TMT from that followed in the Army Individual Test in that he allowed the patient to complete the test in each instance, rather than removing the test when the subject reached the third circle beyond his point of error. He did this in order to observe how often the number-letter sequence would be lost in Part B. He also believed that removal of the test, following an undetected error, increased the sense of failure and inadequacy in the subject. His scoring method, as with the Army Individual Test, was based on total time with partial credits for longer time scores and no credit when the test was completed with uncorrected errors.

Since this was an empirical study, Armitage's interpretations of his findings were both statistical and observational. In Part A there was not a significant difference between his groups in the total number of errors made, but when the groups were compared on the ability to correct their errors a significant difference was obtained. The outstanding reason for the low mean score of the brain-injured group was their lack of planning

¹ p.31.
and anticipation. Armitage found that 90% of the organic's errors were due to this failure, while 80% of the controls' errors were caused by omitting circle 24 in their haste to finish.

In Part B, both number of errors and ability to correct errors were significant between the experimental and control group. Armitage mentions that in both Part A and Part B, only two subjects in the brain-damaged group were able to correct their errors. In discussing the dual relationship in Part B, Armitage found that most of the brain-damaged group lost the relationship before the test was completed and the few that succeeded worked very slowly, constantly repeating aloud the formula, "number-letter".

He found that Part A made the better discrimination between the groups in that with a cutting score of 10, 32 of the 44 organics were identified. Although Part B identified 39 out of the 44 organics, it misclassified 15 of the 51 normals. A combined score did not increase the discriminating power.

In an earlier part of this study Armitage had evaluated several tests previously used in diagnosing brain damage, among them the MAS (Wechsler Mental Abilities Scale). Among the subtests of the MAS are Block Design and Object Assembly which require planning and anticipation
capacity on the part of the subject. Armitage obtained a significant correlation between these tests and the TMT and suggested that this relationship supports his theory that brain injury causes impairment which reduces the degree of individual differences among brain-damaged subjects in their performance on certain tests.

His brief evaluation of the TMT in relation to his criteria for a screening test for brain damage seemed to indicate the following: 1) The TMT fulfilled the requirement of being brief. 2) The subjects found it relatively uninteresting when compared to the Patch Test. 3) The TMT did not seem to allow the patient to experience the successful performance which Armitage felt was necessary. 4) The results suggest that the TMT is not affected by neuroses. 5) The subtests as a whole, including the TMT, included a variety of those functions which seem to suffer most heavily from brain damage. 6) The patients seemed to feel that the subtests, including the TMT, were sensible. 7) The TMT seems to rely on "old learning", i.e., the sequence of numbers and the alphabet. 8) In every instance the subtests, including the TMT, demonstrated a marked relationship between no brain injury and high scores on the subtests. Further, biserial coefficients between the neurotics and normals obtained no significant differences
in their performances. 9) None of the patients' failures seemed to be due to lack of understanding of the directions.
10) The TMT offered difficulty to the individual who had the use of only one hand.

B. Yates

In another paper evaluating old and new tests of brain damage, Yates (122) had only Armitage's study on which to comment. He wrote that Armitage's results indicated that the TMT was a useful test, although further study was warranted. He suggested that inadequate vision could have been a factor contributing to the poor scores on the TMT, and that while the test could be successful in identifying patients with penetrating wounds to the brain, it might be less successful with groups suffering diffuse impairment.

III. Studies of the TMT as a diagnostic technique

A. Reitan

Reitan (81) was the first to follow up Armitage's work in an attempt to determine the validity of the TMT. Both his brain-damaged and his control group numbered 27 patients matched for sex, colour, chronological age and education. The mean age for both groups was thirty. His brain-damaged group consisted of brain tumors, penetrating head injuries, closed head injuries, cerebral vascular accidents, cerebral abscesses, cerebral atrophy, subdurae
hematoma, temporal lobectomy, dementia paralytica and congenital anomaly of the brain. The control group consisted of chronically ill, hospitalized patients whose illnesses ranged from surgery not involving the brain to neuroses.

Reitan altered the administration of the TMT in two ways. First, when the subject made an error, the Examiner immediately pointed it out and asked the subject to correct it. Second, the test was not discontinued prior to completion no matter how difficult it was for the subject or how many errors were made. The score was based on the time necessary to complete each part. The raw scores were then converted to the 10 point scale in the Army Individual Test Manual, with the best performances receiving 10 credits.

Reitan obtained highly significant (p < .001) inter-group differences with both Part A, Part B, and with the combined A and B scores. He concluded that his findings supported Armitage's and that the TMT could possibly be used to indicate certain effects of brain damage.

It would seem that these results should be evaluated rather cautiously since his numbers in both groups were small and he failed to match for intelligence. The latter produces questions in that Reitan's organic group included
congenital anomaly of the brain, cerebral atrophy and demential paralytica. A third group of normals would have been helpful in order to compare the results of both groups with them.

B. Davids, Goldenberg and Laufer

Davids, Goldenberg and Laufer (20), in a study already mentioned in Chapter 3, investigated the use of the TMT and the SAET with ten-year-old, brain-damaged children of normal intelligence. Their three groups consisted of 15 cerebral palsied children with known cortical damage, 29 emotionally disturbed children and 24 normal children.

Their method of administering the TMT for both Parts A and B was to have the Examiner point out each error the instant it was made and to request the child to correct it. The test was not terminated before it was completed. The scores, which were used for the statistical analysis, were the number of seconds taken to complete the tests.

Both Part A and Part B separated all groups at significant levels of confidence with the exception that Part B failed to discriminate between the Psychiatric and the Organic groups.

A significant correlation ( -.60 ) was obtained between the TMT-B scores and the IQs within the normal group. However, this was not found with the other two groups.
When the authors sought a relationship between the TMT and the SAET scores, they found that when the three groups were combined, the degree of association was significant ($p = .01$). However, the Psychiatric group's Part A scores were not related to the SAET.

Davids, Goldenberg and Laufer suggested that in the Psychiatric group the Part A scores were susceptible to impulsivity, while Part B was possibly more susceptible to cortical impairment than Part A. Thus, they consider Part B the better test of organicity. They concluded that both the SAET and the TMT possess considerable promise for detecting cortical damage in children.

It is possible that Davids, Goldenberg and Laufer's method of administering the test, i.e., pointing out each error for correction until the test was completed, may have eventually lead to their measuring variables other than organicity, i.e. mistakes precipitated by transient emotional factors such as anger, frustration or anxiety.

C. Smith and Boyce

In a recent study, Smith and Boyce (95) investigated the relationship between functional psychiatric disorder and performance on the TMT. Their 52 subjects were adult schizophrenics diagnosed as Schizophrenic Reaction, Chronic Undifferentiated Type. They used the Minnesota Multiphasic Personality Inventory as their measurement of
symptomatology. The MMPIs were administered in group form and the TMT individually. Testing, which was apparently completed in a single session, lasted less than three hours.

The scoring method followed Reitan's (81), and raw scores, i.e., time in seconds necessary for completion, were converted to credit scores. The scores obtained by one of Reitan's normal groups and one of his brain-damaged groups were then used as tentative standardization data.

Smith and Boyce obtained no significant difference between the performances of the Brain-damaged and Schizophrenic Groups, although both groups performed significantly worse than the Normal Group. They also found that increased psychiatric symptomatology was concomitant with increased performance time or poorer scores on the TMT. They concluded that factors other than brain damage or organic pathology may influence the TMT.

It would seem that a criticism of this study is that the experimental and control groups were not exposed to identical experimental conditions. Further, one questions if the length of the testing time of the experimental groups could not have increased symptomatology.

IV. The Inclusion of the TMT in the Present Study

Although the TMT has not been adequately validated except as part of the Army Individual Test, where it was
validated against the Army's own General Classification Test; it has nevertheless demonstrated some promise as a useful technique in detecting cerebral dysfunction (see Appendix G). Thus, it was included, on an empirical basis, in the present study.

In a small pilot study, it was ascertained that the normal ten-year-old child can negotiate both Part A and Part B of the test without difficulty. It was also observed that if the test were difficult for the child, tension seemed to increase in proportion to the number of errors and necessary corrections. This seemed to set in at about the 5th error, although occasionally, the child continued the test without further difficulty. Beyond the 6th error, completion of the test rarely occurred without further errors. Thus, the 4th error was arbitrarily chosen as the number beyond which the Examiner would cease to point out mistakes or ask for corrections.

The writer has scored both Part A and Part B on the basis of 0 to 6, with 0 indicating a perfect score and 6 indicating the maximum number of errors. The method of using the time in seconds for the completion of the tests, with correction time for each error included, was discarded because it seemed too traumatizing to force upon a brain-damaged or emotionally disturbed child. In the present study, if the child seemed aware of his errors, the
substitute TMT was utilized at the second error beyond the 4th correction. If the child did not seem aware of errors at the 4th correction, he was allowed to complete the test without further interruption from the Examiner, which he usually did.

The writer believes that the test has many assets of an adequate screening technique in its brevity, innocuous content, ease of administration and permanence as an objective record. Hence the goals of the present study are to ascertain if sexual and actually actual has practical value for use with children, to determine if the Bender-Gestalt can be utilized in combination with the SRT and the TMT, and finally, to attempt to refine the technique as a screening tool.
Chapter 5

THE PRESENT STUDY

I. Introduction

It is the opinion of the writer that the Bender-Gestalt Test has little value as a screening tool in its present form. Although for the past decade clinicians have used it together with other tests in diagnosing emotional disturbance and cerebral dysfunction in children, they have differed in their methods of interpretation and in the amount of weight they have given to the evidence provided by the Bender-Gestalt. Although many papers have been published, with the exception of Quast (80), there has been a paucity of communication about general interpretative methods applicable to daily work in evaluating children's protocols in psychodiagnostic testing.

The writer believes that the test has many assets of an adequate screening technique in its brevity, innocuous content, ease of administration and permanence as an objective record. Hence the goals of the present study are to ascertain if Pascal and Suttell's method has practical value for use with children; to determine if the Bender-Gestalt can be utilized in combination with the SAET and the TMT; and finally, to attempt to refine the technique as a screening tool.
In pursuit of the latter, the writer has tried to isolate those deviations which occur in the protocols of emotionally disturbed children more often than in normals, and those deviations which are found more often in organic records than in records of normals and the emotionally disturbed. It is believed that these are the deviations which experienced clinicians interpret subjectively when evaluating protocols. An attempt has been made to separate them out in order to utilize and transmit the information.

II. Subjects

Each child participating in the present study fulfilled the following basic criteria; his age fell within the range from 10-0 through 14-11 and his I.Q. was of at least 75, with the majority of subjects in each group falling well within the normal intelligence range. It was ascertained that each child had had his vision tested within the past two years, and when the situation arose where a child normally wore glasses, but they were unavailable at the time, the child was excluded from the study.

In an effort to secure the children's efforts and cooperation, no child was included in any group who did not volunteer to participate. Each child was tested
individually by the writer, which required approximately 25 minutes per child.

Thorough notes were taken during each child's performance of the Bender-Gestalt, while any unusual behaviour was carefully noted on the SAET and TMT. (See Test Record in Appendix G).

A. The Normal group

The 200 children composing the Normal Group (see Table 1) all attended private schools, comprehensive schools or secondary modern schools in the London area. They were tested during the ordinary school day in private, quiet rooms provided by the schools.

<table>
<thead>
<tr>
<th>C.A.</th>
<th>M</th>
<th>F</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-0 to 10-11</td>
<td>12</td>
<td>27</td>
<td>39</td>
</tr>
<tr>
<td>11-0 to 11-11</td>
<td>24</td>
<td>18</td>
<td>42</td>
</tr>
<tr>
<td>12-0 to 12-11</td>
<td>17</td>
<td>18</td>
<td>35</td>
</tr>
<tr>
<td>13-0 to 13-11</td>
<td>16</td>
<td>32</td>
<td>48</td>
</tr>
<tr>
<td>14-0 to 14-11</td>
<td>17</td>
<td>19</td>
<td>36</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td>86</td>
<td>114</td>
<td>200</td>
</tr>
</tbody>
</table>

Following the completion of testing in each class, the teacher was asked by the writer if there was any...
child in her form whom she considered a nuisance or troublesome in the classroom, in comparison to other members of the group. If the teacher immediately named a child, it was noted by the writer. However, if it were necessary for the teacher to stop to consider the various members of her class, it was felt that the child named did not constitute enough of a classroom problem to be included in the group. The final Nuisance Value group consisted of 13 children out of the total 200 in the Normal Group. (See Table 2). They are included in all statistics involving the Normal Group, although for some purposes in this study, they constitute a separate group.

**TABLE 2**

Nuisance Value Children (Normal Group)

<table>
<thead>
<tr>
<th>C.A.</th>
<th>M</th>
<th>F</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-0 to 10-11</td>
<td>2</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>11-0 to 11-11</td>
<td>3</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>12-0 to 12-11</td>
<td>3</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>13-0 to 13-11</td>
<td>1</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>14-0 to 14-11</td>
<td>-</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td>9</td>
<td>4</td>
<td><strong>13</strong></td>
</tr>
</tbody>
</table>
B. The Emotionally Disturbed group

The 60 children composing the Emotionally Disturbed Group (see Tables 3 and 4) were obtained from the Children's Unit of a large mental hospital, from Special Classes for the Emotionally Disturbed, from residential treatment centres, and from children's outpatient psychiatric units in two London hospitals.

**TABLE 3**
The Emotionally Disturbed Group

<table>
<thead>
<tr>
<th>C.A.</th>
<th>M</th>
<th>F</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-0 to 10-11</td>
<td>8</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>11-0 to 11-11</td>
<td>7</td>
<td>5</td>
<td>12</td>
</tr>
<tr>
<td>12-0 to 12-11</td>
<td>9</td>
<td>4</td>
<td>13</td>
</tr>
<tr>
<td>13-0 to 13-11</td>
<td>10</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>14-0 to 14-11</td>
<td>9</td>
<td>5</td>
<td>14</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td>43</td>
<td>17</td>
<td>60</td>
</tr>
</tbody>
</table>

**TABLE 4**
Emotionally Disturbed Group: Treatment and School Placement

<table>
<thead>
<tr>
<th>Placement</th>
<th>M</th>
<th>F</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Institutional resident attending institutional school</td>
<td>18</td>
<td>4</td>
<td>22</td>
</tr>
<tr>
<td>Outpatient attending special class for emotionally disturbed</td>
<td>9</td>
<td>9</td>
<td>18</td>
</tr>
<tr>
<td>Outpatient attending ordinary school</td>
<td>17</td>
<td>3</td>
<td>20</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td>44</td>
<td>16</td>
<td>60</td>
</tr>
</tbody>
</table>
The group cannot be considered uniform either in the severity or duration of their illnesses, or in the amount and quality of treatment they have received. Further, their prognoses probably range from poor to good.

Each child had received a psychodiagnostic evaluation and had been seen by a psychiatrist at the time he was seen by the writer. As with the Normal Group, no child was tested unless he had agreed to participate. No child was overtly psychotic at the time of testing.

C. The Cerebral Dysfunction group

The Cerebral Dysfunction Group was a much more difficult group to obtain than the other two groups. This was primarily due to the facts that first, for the purposes of the present study, the writer did not wish to use a group composed completely of children suffering epilepsy; second, children suffering severe motor impairment were eliminated in the Cerebral Palsy Group, and third, the requirements of an IQ of at least 75 automatically eliminated many children with diagnosed brain damage.

In the present group of 39 children, (see Tables 5 and 6) all of the Epileptics have abnormal EEGs, the majority with focal lesions, while the few Neurologically Damaged have known focal lesions. However, with the
Cerebral Palsied children, although psychological and neurological evaluations were available, not all of the children had been administered EEGs. Further, cortical damage cannot necessarily be inferred from motor impairment. A further break-down of the Cerebral Dysfunction Group is included in Appendix F.

As with the other groups, no child was tested unless he volunteered. In general, the testing took longer with each child than with the other two groups.

The children in this group were obtained from residential treatment centres and schools for epileptics, residential treatment centres and schools for cerebral palsied children, and from the psychiatric outpatient unit of a Children's Hospital in London.

**TABLE 5.**
The Cerebral Dysfunction Group

<table>
<thead>
<tr>
<th>C.A.</th>
<th>M</th>
<th>F</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-0 to 10-11</td>
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<td>1</td>
<td>6</td>
</tr>
<tr>
<td>11-0 to 11-11</td>
<td>6</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>12-0 to 12-11</td>
<td>5</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>13-0 to 13-11</td>
<td>7</td>
<td>-</td>
<td>7</td>
</tr>
<tr>
<td>14-0 to 14-11</td>
<td>6</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
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<td>10</td>
<td>39</td>
</tr>
<tr>
<td>Diagnostic Categories</td>
<td>M</td>
<td>F</td>
<td>Total</td>
</tr>
<tr>
<td>-----------------------</td>
<td>-----</td>
<td>-----</td>
<td>-------</td>
</tr>
<tr>
<td><strong>Epileptics:</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>10-0 to 10-11</td>
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<td>1</td>
<td>1</td>
</tr>
<tr>
<td>11-0 to 11-11</td>
<td>2</td>
<td>1</td>
<td>3</td>
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<tr>
<td>12-0 to 12-11</td>
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<td>3</td>
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<td><strong>Total:</strong></td>
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<td>14-0 to 14-11</td>
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<td>5</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
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<td>17</td>
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<tr>
<td><strong>Neurological Damage:</strong></td>
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<td>10-0 to 10-11</td>
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<td>1</td>
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<td>11-0 to 11-11</td>
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<td>-</td>
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<tr>
<td>14-0 to 14-11</td>
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<td>-</td>
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<tr>
<td><strong>Total:</strong></td>
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<td>3</td>
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<td><strong>Controversial Diagnoses:</strong></td>
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<tr>
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<tr>
<td>14-0 to 14-11</td>
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<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
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<td>5</td>
</tr>
<tr>
<td><strong>Total Cerebral Dysfunction Group:</strong></td>
<td>29</td>
<td>10</td>
<td>39</td>
</tr>
</tbody>
</table>
III. The Test Battery

A. The Spiral Aftereffect Test

Two 6-inch discs, Spiral A (clockwise) and Spiral B (counter-clockwise), each providing 920 degrees of spiral and revolving at 78 rpm were used in the present study. The spiral was mounted on a double spring gramaphone motor, which functioned in complete silence. (See Plate 2).

Four trials were administered to each subject, each trial requiring a response while the spiral was rotating and a response immediately after the rotation had stopped. A score of 1 was given for each correct response, with a total possible score of 8.

Each subject was seated facing the Spiral which was located at eye level at a distance of exactly eight feet away. The directions, spoken in each instance before administering the Archimedes were as follows:

"This is a special eye test. (E. pointing to the centre of the disc and then roughly tracing the black line while speaking) I am going to spin this disc. While it is going around, I am going to ask you what this black line seems to be doing. (Pause) Then, I am going to stop it spinning; and immediately after it has stopped, I am going to ask you again what the line seems to be

1 This equipment was made to the writer's specifications by Palmers Ltd.
doing. Look directly at the centre (pointing at button) and don't take your eyes away even while speaking. Do you have any questions?" The E. answered any questions and did not start testing until satisfied that the S. was prepared.

If the child failed the first trial, on the second trial he was questioned directly, "Is it getting larger? smaller? or does it remain the same?"

The Subject's responses were recorded verbatim on the Record Sheet. (See Appendix G.)

B. The Bender-Gestalt Test

The Bender-Gestalt Test (see Plate 1) consists of nine white, 4 x 6 inch cards, upon each of which is printed a different geometric figure. Each design is printed in black along the horizontal axis of the card. With the exception of the first card, which is lettered "A", the remaining eight cards are numbered from 1 through 8 (on the reverse side).

The Subject, seated across the table from the Examiner, was requested to copy the designs on a quarto size sheet of white paper. On the table, in clear view, were additional paper and an eraser, which the Subject could use if he wished. The cards, which had been stacked face down on the table in front of the Examiner, were then placed,
one at a time, face-up before the Subject, in the order A through 8. Each card was exposed for as long a period as the Subject required in order to copy the design to his satisfaction.

Requests for further directions or help by the Subject were responded to in a non-directive manner, e.g., "...it's up to you." or "whatever way you think best."

Space was provided on the Record Sheet for recording time, handedness, and notes on the child's approach and manner of reproducing each figure. Remarks were also noted.

C. The Trail-Making Test

The version of the TMT used in the present study is a variation, constructed by the writer, of the TMT as used by the Adjutant General's Office, U.S. Army, as part of the Army Individual Test.

Part A of the writer's adaptation consists of 25 circles, each containing a number from 1 to 25 placed at random on the sheet (See Appendix G). Part B also consists of 25 circles, 13 containing numbers and 12 containing the letters A to L, also placed at random on the page (See Appendix G).

As an introduction to the task, the Subject was shown a sample sheet, on which were printed seven circles, placed at random, each containing a number from 1 to 7.
The Examiner, after showing this to the Subject, said, "There are seven circles on this paper. I am going to join them with a pencil in the same way that I would count from one to seven." The Examiner then joined the circles with a pencil, beginning with number 1 and ending with number 7. The Examiner then asked the Subject if he understood and when assured, presented Part A saying, "Now I want you to start at number one (pointing to the circle containing the number 1) and join the circles on this paper in the same way. This time there are twenty-five circles." After the Subject had placed his pencil on number 1, the Examiner nodded approval and said, "Go ahead."

The directions for Part B were as follows: "This test is more difficult. It will be easier if you use a red pencil, (handing the child a pencil with red lead). This time you are to alternate, that means to go back and forth, between numbers and letters. I will help you get started." Here the Examiner showed the Subject the circle containing number 1 and asked him to place his pencil on it. The Examiner then continued, "Remember, you are to go back and forth between numbers and letters... first a number...then a letter...then a number...then a letter...What would the first letter be?" The child usually indicated the letter A and the Examiner helped
him to draw a line from 1 to A. (Help was then given on A to 2, 2 to B, and B to 3). The child was requested to hold his pencil on 3, and when the Examiner was satisfied that the directions were understood, said, "The last number will be 13 and the last letter will be L. Go ahead and finish it."

Errors were pointed out and help was given to the child in correcting them. However, corrections ceased beyond the 4th error. If a child were unable to comprehend the directions, a substitute form was given which almost assured the child success. (See Appendix G). In the substitute form the letters were colored red and the numbers blue. Fewer of both were used and the child was asked to follow the numbers consecutively, i.e., "Connect them in the same way you would count from one to eight", followed by, "Now connect the letters in the same way you would say the alphabet from A to G."

In situations where the substitute form was used, the Subject received a score of 6 (errors) on the TMT-B.

The tests were administered in the following order; SAET, Bender-Gestalt, and TMT. The SAET was given first because the presence of the small box in which the apparatus was encased aroused curiosity and possibly anxiety in the child, which would possibly have interfered
with the performance on the other tests if allowed to continue. The Bender-Gestalt was second because the blank paper, pencils and eraser were also in plain sight. Also, since the major portion of this research is devoted to the Bender-Gestalt, the Examiner was anxious to have it completed before exposing the child to the TMT, which in some instances could be discouraging.

The tests seemed to have high interest value for the children in that they were not easily distracted from them and no child refused to attempt or to complete them to the best of his ability. Each child in the populations studied completed all three tests, although in a few instances it was necessary to utilize the supplemental form for the TMT-B.
Chapter 6

THE RESULTS OBTAINED WITH THE PASCAL-SUTTELL
SCORING METHOD, THE SAET AND THE TMT.

I. Introduction

Following the administration of the test battery to three groups, the Bender-Gestalt protocols were scored by the Pascal-Suttell method which produced raw scores; the SAET was scored on the eight credit basis previously described, i.e., two trials on Spiral A and two trials on Spiral B with credits for both rotating and negative after-images for each spiral; and the TMT was scored on the number of errors obtained on Part A, and on a 0 to 6 score on Part B.

The scores obtained for each test were then treated statistically in order to determine the ability of each test to discriminate between individuals and between groups; tests were made for maturational factors; and finally, attempts were made to determine if any of the tests or parts of the tests could be separated out to be used in combination with other parts in an effort to create a similar test battery scored by different methods.

The findings will be considered in the following order: the Spiral Aftereffect Test, the Trail Making Test, and the Bender-Gestalt Test.
II. Results

A. The SAET

While significant differences were obtained between the means of the experimental groups (see Table 8), the overlap between the groups was too large in both directions to warrant the use of the SAET as an individual screening test (See Fig. 1). Although direct questions giving the child a choice of descriptive labels for the aftereffect were asked in each case on the second trial, only 78% of the 200 children in the Normal Group obtained 8 scores (all effects and aftereffects correctly reported), while 26% of the children diagnosed as suffering some degree of cerebral dysfunction achieved this score. Because of this finding, one questions the statement in the Spiral After-effect Manual (66) that, "Any subject who is unable to perceive the aftereffect of even one of the eight trials should be considered as probably having intra-cranial pathology." The Manual continues that illness, particularly when fever is present, severe visual difficulties, severe depressed states, paranoid conditions, poor attention span, and distraction during the stimulus process would account for normals and functional cases occasionally failing to perceive one or more of the aftereffects. It should be reiterated that the children in

1 For Means and Standard Deviations of Groups on the SAET, see Table 7.
2 p.6.
### TABLE 7
Means and Standard Deviations of Groups on the SAET.

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>200</td>
<td>7.51</td>
<td>1.11</td>
</tr>
<tr>
<td>Emotionally disturbed</td>
<td>60</td>
<td>6.83</td>
<td>1.51</td>
</tr>
<tr>
<td>Cerebral dysfunction</td>
<td>39</td>
<td>4.89</td>
<td>2.32</td>
</tr>
</tbody>
</table>

### TABLE 8
Difference between mean SAET Scores of the Groups.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Value of t</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cerebral Dysfunction and Normal</td>
<td>6.84</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Cerebral Dysfunction and Emotionally Disturbed</td>
<td>4.57</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Normal and Emotionally Disturbed</td>
<td>3.23</td>
<td>&lt;.01</td>
</tr>
</tbody>
</table>
the Normal Group of the present study were not mentally retarded; were free from severe visual difficulties, and were tested in quiet, isolated rooms during the course of the normal school day. The last suggests the absence of illness in the majority of cases. Thus, the question arises whether or not scores of 6 or 7 are not possible artifacts, as is also suggested in the Manual, rather than indications of probable intra-cranial pathology.

If one can assume that an approximate 10% of children within the normal school population are suffering some degree of inadequate adjustment possibly contributing to transient emotional factors, intermittent lapses of attention and easy distractibility, it is doubtful that these would all be screened by the SAET, and if they were, it would still be necessary to account for the remaining 12%.

In the Emotionally Disturbed Group 56% of the children obtained a perfect score, or 8, while 25% of them received a score of 5 or below. Although one would have cause to suspect that undiagnosed cerebral dysfunction is possibly more prevalent among emotionally disturbed children than among normals, this percentage too, seems unduly high. Blau and Schaffer (11) and Hanvik et al. (45) conservatively estimate that cerebral dysfunction occurs in approximately 10% of the intake in Child Guidance Clinics. Thus, the
Emotionally Disturbed Group's 25% seems far out of line. (See Figure 2).

Although a difference was observed between the means of the 10 and 11-year-old normal groups, this was in the wrong direction to suggest the influence of maturational factors, and the differences between the age groups from 10 through 14 years (excluding 11 year-olds) were not significant.¹ (See Figure 2).

Since the difference between the means of the Cerebral Dysfunction and the Normal Groups was significant at the .1% level and since the mean score for the Cerebral Dysfunction Group was 4.89, a score of 4 or below on the SAET was retained as an item to be further evaluated in a screening battery for cerebral dysfunction which will be discussed in Chapters 7 and 8.

B. The TMT

Of the two scoreable sections of the TMT, Part A and Part B, only Part B was found to discriminate significantly between the Cerebral Dysfunction and Normal as well as between the Cerebral Dysfunction and Emotionally Disturbed Groups. As with the SAET, the difference between the means of both the Cerebral Dysfunction and Normals, and Cerebral Dysfunction and Emotionally Disturbed Groups was significant at the .1% level. Yet, overlap was too great in both directions to consider the test for

¹ Mean values for ages 10, 11, 12, 13 and 14 were 6.84, 6.12, 7.71, 7.70 and 7.55 respectively.
Figure 2. SAET: Age-Score Relations
individual prediction purposes (See Tables 9, 10 and Fig.3).

However, in contrast to the SAET, no significant difference was obtained between the means of the Emotionally Disturbed and Normal Groups, suggesting that the TMT-B was tapping factors related only to the group diagnosed as suffering some degree of cerebral dysfunction, and present to only a small degree, if at all, in the Emotionally Disturbed and Normal Groups. This is illustrated by the fact that 49% of the Cerebral Dysfunction Group made a score of 6 (maximum number of errors), while only 3.5% of the Normal Group and 10% of the Emotionally Disturbed Group obtained this score. Thus, although the TMT, per se, proved of little value for individual screening purposes in that 51% of the Cerebral Dysfunction Group were misclassified, a 6 score on Part B was retained as a supplement and counter-balance item to the 4 score on the SAET in a proposed screening battery for cerebral dysfunction.

TABLE 9
Means and SDs of Groups on TMT-B.

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>200</td>
<td>1.25</td>
<td>1.50</td>
</tr>
<tr>
<td>Emotionally Disturbed</td>
<td>60</td>
<td>1.73</td>
<td>2.06</td>
</tr>
<tr>
<td>Cerebral Dysfunction</td>
<td>39</td>
<td>3.84</td>
<td>2.33</td>
</tr>
</tbody>
</table>
TABLE 10.
Difference between mean TMT-B Scores of the Groups

<table>
<thead>
<tr>
<th>Groups</th>
<th>Value of t</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cerebral Dysfunction and Normals</td>
<td>6.60</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Cerebral Dysfunction and Emotionally Disturbed</td>
<td>4.55</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Normals and Emotionally Disturbed</td>
<td>1.66</td>
<td>&gt;.05</td>
</tr>
</tbody>
</table>

In addition, the TMT protocol produced in a number of instances a fragmentation phenomenon in its reproduction which occurred only with children in the Cerebral Dysfunction Group (See Plates 36 and 37). This proved to be significant at the .1% level and was also retained for further use. For want of another term, this phenomenon is referred to as 'Fragmentation TMT A or B' in this thesis.

C. The Bender-Gestalt Test as Scored by the Pascal-Suttell Method

1. Age Effect

The scores of the Normal Group exhibited a marked age effect at the 10 and 11 year levels, with a decline in scores beginning at age 12 which continued to decrease through age 14. The only significant difference between the means when compared at each age level was found between

1 The writer, having scored the 25 practice records in Pascal and Suttell's Manual, obtained a coeff. of rel. of .91 with their scores on the 20 remaining records.
Figure 3. TMT-B Scores of Each Group

- Normals N = 200
- Emotionally Disturbed N = 60
- Cerebral Dysfunction N = 39
the eleven and twelve-year-olds. (See Tables 11 and 12)

Unfortunately, Pascal and Suttell's experimental group
of normal children ranged in age from 6-3 years to 9-3 years
and their adult group started at 15 years, which offers no
opportunity for comparison with the present data. However,
with their small groups of young children they obtained a
negative correlation of .58 between Bender-Gestalt raw
score and age in months.

<table>
<thead>
<tr>
<th>TABLE 11</th>
</tr>
</thead>
<tbody>
<tr>
<td>Means and Standard Deviations of Normal Age Groups scored by Pascal-Suttell method.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ten Years</td>
<td>39</td>
<td>42.56</td>
<td>14.66</td>
</tr>
<tr>
<td>Eleven Years</td>
<td>42</td>
<td>41.05</td>
<td>11.80</td>
</tr>
<tr>
<td>Twelve Years</td>
<td>35</td>
<td>33.57</td>
<td>10.60</td>
</tr>
<tr>
<td>Thirteen Years</td>
<td>48</td>
<td>31.58</td>
<td>9.73</td>
</tr>
<tr>
<td>Fourteen Years</td>
<td>36</td>
<td>28.25</td>
<td>9.89</td>
</tr>
</tbody>
</table>

1 20 children ages 6-3 to 7-1, 14 children ages 7-2 to 8-2, 12 children ages 8-3 to 9-0.
TABLE 12

Significance of Difference between Mean Pascal-Suttell Raw Scores at Progressive Age Levels.

<table>
<thead>
<tr>
<th>Age Levels</th>
<th>Value of t</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ten Years and Eleven Years</td>
<td>.24</td>
<td>-</td>
</tr>
<tr>
<td>Eleven and Twelve Years</td>
<td>2.89</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Twelve and Thirteen Years</td>
<td>.86</td>
<td>-</td>
</tr>
<tr>
<td>Thirteen and Fourteen Years</td>
<td>1.52</td>
<td>-</td>
</tr>
</tbody>
</table>

2. The Normal and Emotionally Disturbed Groups

The mean raw score for the Normal Group obtained in the present study was 35.55 with a standard deviation of 12.73, while the mean score for the Emotionally Disturbed Group was 52.33 with a standard deviation of 22.95 (See Table 13).

Although the difference between the means of the Normal and Emotionally Disturbed Groups was significant at the .1% level, (see Table 14) overlap was very great, as is demonstrated by the fact that 10.5% of the Normals obtained scores at or above the mean of the Emotionally Disturbed Group, while 35.6% of the Emotionally Disturbed obtained scores at or below the Normal mean.
### TABLE 13
Means and Standard Deviations of Groups Scored by Pascal-Suttell Method

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>200</td>
<td>35.55</td>
<td>12.73</td>
</tr>
<tr>
<td>Emotionally Disturbed</td>
<td>60</td>
<td>52.33</td>
<td>22.95</td>
</tr>
<tr>
<td>Cerebral Dysfunction</td>
<td>39</td>
<td>83.98</td>
<td>33.88</td>
</tr>
</tbody>
</table>

### TABLE 14
Difference Between Mean Pascal-Suttell Raw Scores of the Groups

<table>
<thead>
<tr>
<th>Groups</th>
<th>Value of t</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normals and Emotionally Disturbed</td>
<td>5.51</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Normals and Cerebral Dysfunction</td>
<td>8.69</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Cerebral Dysfunction and Emotionally Disturbed</td>
<td>5.08</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

3. The Normal and Cerebral Dysfunction Groups

The mean score for the Cerebral Dysfunction group was 83.98 with a standard deviation of 33.88. The difference between the Normal and Cerebral Dysfunction means was significant at the .1% level. Although 10.3% of the Cerebral Dysfunction Group scored at or below the mean of the Normal Group, none of the Normals obtained
scores at or above the Organic mean, which suggests that the technique is more effective in discriminating between Cerebral Dysfunction and Normals than between Emotionally Disturbed and Normals.

4. The Cerebral Dysfunction and Emotionally Disturbed Groups

In the comparison of the Cerebral Dysfunction scores with those of the Emotionally Disturbed, the difference between the means of the two groups was also significant at the .1% level, although 23% of the Cerebral Dysfunction Group obtained scores at or below the Emotionally Disturbed mean, while 10% of the Emotionally Disturbed Group obtained scores at or above the Cerebral Dysfunction Group mean, which suggests that there is too much overlap for the technique to be effective in this area for individual screening purposes.

5. Individual Discrimination

When evaluating Pascal and Suttell's method for individual prediction purposes, cutting scores were established for the Emotionally Disturbed Group and for the Cerebral Dysfunction Group.

In the consideration of the Emotionally Disturbed Group, the best cutting score was found to be 44. When this was applied, 45 or 22.5% of the Normal Group scored
at or above the cut, while 21 or 35% of the Emotionally Disturbed Group fell below it. The total loss was 66 subjects or an average misclassification of 28.8% of the combined populations. (See Appendix H)

Since the difference between the means of the 11 and 12-year-olds was significant at the 1% level, a further attempt was made to refine the technique by combining the 10 and 11-year-olds and applying a separate cutting score, and by combining the 12, 13 and 14-year-olds for the same purpose. Neither one of these efforts obtained a cutting score more effective than the cut of 44 for the total group.

The results were considerably better when the best cutting score, or 59, was applied to the Cerebral Dysfunction Group. At this cut only 10 or 5% of the Normals were misclassified, while 9 or 23% of the Cerebral Dysfunction Group fell below the score. The total misclassification was 19 or an average of 14.03%. Thus the ability of the Pascal-Suttell scoring method in individual prediction between Cerebral Dysfunction and Normals is far superior to its ability to discriminate between Emotionally Disturbed and Normals.

III. Discussion

In considering these findings produced by the
Pascal-Suttell method, it is the opinion of the writer, unsupported by experimental evidence, that as many as a third of the items scored by Pascal and Suttell could be eliminated with little sacrifice of the discriminatory power of the technique. Although their method, per se, is an improvement in time involved on Billingslea's scoring system, and less nebulous and easier to score than Gobetz's and Hutt's, it nevertheless remains time consuming, inconsistent and vague in scoring directions, and leaves much to be desired as a clinical tool.

It is further opined by the writer that, although the method evaluates 105 items, Pascal and Suttell have missed significant areas provided by the protocol, which possibly have more sensitive discriminatory capacity than those they are measuring. In short, it is believed that a briefer scale composed of fewer and more powerful items, including a few of Pascal and Suttell's and a few combinations of others, could discriminate at least as well and possibly with more sensitivity than Pascal and Suttell's method. Two scoring systems which partially fulfill these needs are proposed in the following section.
Chapter 7

PROPOSED SCREENING SCALES

Screening Scale A (Emotional Disturbance)
Screening Scale B (Neurological Referral)

I. Introduction

In addition to the criteria proposed by Armitage (3), it would seem that a requirement of any screening test to be used with emotionally disturbed or brain-damaged children, would be to gain the maximum necessary information in the minimum amount of time. This is not only in the interest of the child, but also of the Examiner for whom a great portion of the testing process is devoted to follow-up scoring, interpretation and writing of the report.

In a clinical setting, screening can sometimes be difficult since children with severe brain damage or with psychiatric states have usually been recognized and cared for before the age of ten years. Thus a number of border-line cases in the ten through fourteen-year age groups often appear as clinic referrals. Hence, there is a need for a screening test which is brief enough to be used as an individual unit in order to indicate what further testing is to be done, or to be included as part of the psychodiagnostic battery as further weight to the findings.
The writer proposes two methods of utilizing the same data in scales that are brief and easy to score. The first, Screen Scale A (Emotional Disturbance), is proposed as a method of determining the presence and possibly, to some extent, the degree of emotional discomfort in the child from 10 through 14 years of age. The second, Screening Scale B (Neurological Referral), is proposed as a method of screening for the possibility of cerebral dysfunction in the child from 10 through 14 years of age.

The two scoring systems offer the clinician a choice in that Screening Scale B may be helpful when a decision is necessary as to whether the child should be referred for a neurological evaluation. Although this is a decision which could necessitate more caution in the United States than in England because of the lack of a National Health Plan, in England, too, it is important in clinical situations where to refer for an unnecessary neurological evaluation can cause inconvenience for the parents as well as for the neurologist.

It should be emphasized that these scales are not diagnostic techniques. Their proposed value is merely in indicating further directions that testing or evaluation should take. Thus, the psychodynamics of the problem
remain to be solved and the presence or absence of cerebral dysfunction remain to be determined with more sophisticated and valid instruments.

Some of the items in Scale A and Scale B are used in the same way as in Pascal and Suttell's scoring system. Others are similar in areas used, but are scored according to the writer's criteria. Finally, some deviations from the stimuli are presented which have not been previously incorporated in scoring systems.

In an attempt to avoid inconvenience for the reader, i.e., as would be involved in consulting Pascal and Suttell's Manual (73) in instances where Pascal and Suttell's scoring is used, it is mentioned in the text. Further, their descriptions and some of their illustrations are taken directly from their manual. However, in instances where the writer's criteria are used, illustrations are copies taken directly from the protocols obtained in the present study.

This chapter of the thesis is devoted purely to a description of the proposed scales and the scoring technique involved. The evaluation of the scale and of the items which make them up will be given in the next chapter.

1 Such direct quotations from the manual are given between inverted commas. Page references have not been given since the excerpts are so numerous that such references would disrupt the continuity of the text. The reader will find that the quotations come from pages 110-207 in the Pascal and Suttell manual (73).
SCREENING SCALE A

(Emotional Disturbance)
### Plate 3. Screening Scale A
(Emotional Disturbance)

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item 1</td>
<td>3 for 5° Tilt</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Degrees of Tilt</td>
<td></td>
</tr>
<tr>
<td>Fig. 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fig. 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fig. 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fig. 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fig. 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fig. 6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total Tilt

| Item 2 | Design Missing (score 10 each)                   |       |
| Item 3 | Circles Touching (score 6)                       |       |
| Item 4 | Separated by Lines (score 10)                    |       |
| Item 5 | Second Attempt (score 4 each)                    |       |
| Item 6 | Additional Marks (score 10)                      |       |
| Item 7 | Numbering (score 6)                              |       |
| Item 8 | Distortion (score 8 each)                        |       |
| Item 9 | Stretching (score 4 each)                        |       |
| Item 10| Breakage (score 6 for each figure in which breakage occurs) |       |
| Item 11| Tremor (score 8)                                 |       |

Total Score
SCREENING SCALE A  
(Emotional Disturbance)

In scoring, although an item such as Item 10, Breakage, should occur in more than one figure, it is only scored once for the protocol unless it is specifically indicated otherwise. In such instances this is stated in parentheses.

Item 1 Tilt (score 3 for each 5° of tilt)

3 for 5° Tilt

This is scored separately for Figures 1, 2, 3, 4, 5 and 8. Each figure is scored 3 points for each unit of 0 through 5 degrees of tilt as follows:

<table>
<thead>
<tr>
<th>degrees of tilt</th>
<th>score points</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-4</td>
<td>0</td>
</tr>
<tr>
<td>5-9</td>
<td>3</td>
</tr>
<tr>
<td>10-14</td>
<td>6</td>
</tr>
<tr>
<td>15-19</td>
<td>9</td>
</tr>
<tr>
<td>20-24</td>
<td>12</td>
</tr>
<tr>
<td>25-29</td>
<td>15</td>
</tr>
<tr>
<td>etc.</td>
<td>etc.</td>
</tr>
</tbody>
</table>

Each figure is scored for degrees of tilt from the horizontal axis. The degrees are measured from the left extremity of the figure to the right extremity, along that portion of the figure which extends along the base of the figure. Measurements should be taken along the base of each dot or line. A protractor and a set square are used for this measurement.
Specific measurements:
Fig. 1. Measure base of dot at left extremity with base of dot at right extremity.
Fig. 2. Same as for Fig. 1. Measure along bottom row of circles.
Fig. 3. Measure from base of single dot to base of centre dot or the dot representing the centre of the curve.
Fig. 4. Measure extremities of the horizontal line.
Fig. 5. Measure base of dots at extremities of each arc.
Fig. 8. Measure extremities of the bottom horizontal line only.
Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

Fig. 8
Screening Scale A

Item 2 Design Missing (score 10 each)

This item is scored by the Pascal-Suttell Method.

The scoring is as follows:

Fig. 1 "If the design is reproduced with six or fewer dots."

Fig. 2 Only part of the Pascal-Suttell scoring is used with this figure. It is only scored on one deviation, "when the design is reproduced with two instead of three rows of circles." No illustration is necessary.

Fig. 3 "Scored when one of the rows is missing in the reproduction.

Fig. 4 Scored when more than one third of either the square or the curve is missing.

Fig. 5 Scored when the extension or at least half of the curve is missing.

Fig. 6 Scored when one of the lines, or at least one-half of one of the lines is entirely missing. One-half of a line is defined as two of the sinusoidal curves, regardless of the point of crossing.

Fig. 7 Scored when a major portion of one of the hexagons is omitted.

Fig. 8 Scored when the diamond or at least one-third of either the diamond or the hexagon is omitted."
Note.—Pascal and Suttell give no illustration for Fig. 1.
Screening Scale A

Item 3  **Circles Touching** (score 6)

This item is scored for figure 2, and for figures 3 and 5 when circles are substituted for dots. It is basically scored by the Pascal-Suttell method. To be scored, "the circles must be so placed that they touch or overlap more than once."
Screening Scale A

Item 4  **Separated by lines** (score 10)

This item is scored either when the complete figure is fenced off by lines, or when only part of a figure is separated from another part by a very short line. Thus any use of lines added to the protocol for this purpose is scored.
Screening Scale A

Item 5  Second Attempt (score 4 each)

This item is scored by the Pascal-Suttell method;
"when the subject makes, and fails to erase, more than
one attempt to reproduce the design, the item is scored.
Attempts crossed out, or incompletely erased, are
scored."
Screening Scale A

Item 6  Additional Marks (score 10)

This is scored when marks of any size, not relevant to the design, are made on the paper. This does not include Pascal and Suttell's double lines, guide lines, or dots placed for purposes of planning spatial relationships in the reproduction.
It 12 dots all together

... . . . . . . . . . . . . .

\[ N' \]
Screening Scale A

Item 7  **Numbering** (score 6)

This item is scored when any or all of the designs are numbered in the protocol. An illustration is not necessary.
Screening Scale A

Item 8 Distortion (score 8 each)

This item is scored for figures 3, 4, 5, 6, 7 and 8.

The scoring method and illustrations are Pascal and Suttell's.

Fig. 3 "To score, there should be destruction of the gestalt, resulting in a loose conglomeration of dots or in an extreme departure from the stimulus.

Fig. 4 Rarely encountered; to score the item, the reproduction should be a marked distortion of the stimulus.

Fig. 5 The item is scored:
1) When there are 5 or fewer dots in the curve.
2) When the design is reproduced with lines rather than dots.
3) When the design tends to a closed circle of dots.
4) When there is a marked distortion of the gestalt, resulting in a loose conglomeration of dots or an extreme departure from the stimulus.

Fig. 6 The item is scored:
1) When the sinusoidal curves of one line differ markedly from those of the other.
2) When the two lines do not intersect.

---

1 This reduces this item to subjective scoring in almost every figure. Curnutt (19) considers this "...the weakest sign, not because of its lack of frequency of occurrence, but because of the difficulty in pinning it down".
Fig. 7 The item is scored:

1) When one hexagon is approximately twice the size of the other

2) When the two hexagons do not overlap, or overlap excessively

3) When the design is reproduced in a markedly distorted manner

Fig. 8 The item is scored:

1) When the design is extremely disproportionate in its length to width ratio

2) When the diamond overlaps the hexagon by more than one-third of its area, when the diamond is so small as to cover only two-thirds of the distance between the sides of the hexagon, or when the diamond is placed in one of the extreme thirds of the hexagon

3) When the figure is reproduced in an otherwise markedly distorted manner."
PLATE 13.  Item 3 Distortion

Fig. 7

Fig. 8
Screening Scale A

Item 9 Stretching (score 4 each)

Fig. 1 and Fig. 2. This is scored when the dots in Fig. 1 or the circles in Fig. 2 extend across the page in a perseverative fashion rather than form a configuration similar to the gestalt of the stimulus figure. This may occur even though an approximately correct number of dots or circles is used.
PLATE 14.
Item 9 Stretching

Fig. 1 (original size)

(Stretching)
PLATE 15.

Item 9 Stretching

Fig. 2 (original size)

(stretching)
Screening Scale A

Item 10 **Breakage** (score 10)

This consists of breaking or separating the reproduced design into parts, which does not necessarily destroy the gestalt, although it may. This is usually found in figures 2, 3 and 5. (Note: Pascal and Suttall's item, "Not Joining" in Fig. 4 is not scored as Breakage.)
Fig. 3

Fig. 5
Screening Scale A

Item 11  **Tremor** (Score 8)

Score by Pascal and Suttell's method: "In general, tremulous lines represent varying degrees of departure from clean, firmly-drawn lines. Tremor may be either of two types: fine, almost imperceptible, or gross, i.e., a generally unsteady line with large deviations from the intended direction of the line."
PLATE 13. Item 11 Tremor

Fine Tremor
PLATE 19. Item 11 Tremor

Gross Tremor
<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2 for 5 Tilt</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Degree of Tilt</strong></td>
<td></td>
</tr>
<tr>
<td>Fig.1</td>
<td>8°</td>
<td>3</td>
</tr>
<tr>
<td>Fig.2</td>
<td>6°</td>
<td>3</td>
</tr>
<tr>
<td>Fig.3</td>
<td>2°</td>
<td></td>
</tr>
<tr>
<td>Fig.4</td>
<td>1°</td>
<td></td>
</tr>
<tr>
<td>Fig.5</td>
<td>10°</td>
<td>6</td>
</tr>
<tr>
<td>Fig.8</td>
<td>4°</td>
<td></td>
</tr>
</tbody>
</table>

Total Tilt: 12

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Design Missing (Score 10 each)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Circles Touching (Score 6)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Separated by Lines (Score 10)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Second Attempt (Score 4 each) Fig. 7.</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>Additional Marks (Score 10)</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Numbering (Score 6)</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Distortion (Score 8 each)</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Stretching (Score 4 each)</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Breakage (Score 6 for each figure in which breakage occurs.) Fig. 3.</td>
<td>6</td>
</tr>
<tr>
<td>11</td>
<td>Tremor (Score 8) Figs 4 &amp; 6.</td>
<td>8</td>
</tr>
</tbody>
</table>

Total Score: 30
Plate 22. Scoring Illustration
Screening Scale A.
(Emotional Disturbance)

Item 1  7 for 5 tilt

<table>
<thead>
<tr>
<th>Degrees of Tilt</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fig. 1.</td>
<td>-</td>
</tr>
<tr>
<td>Fig. 2.</td>
<td>2°</td>
</tr>
<tr>
<td>Fig. 3.</td>
<td>1°</td>
</tr>
<tr>
<td>Fig. 4.</td>
<td>1°</td>
</tr>
<tr>
<td>Fig. 5.</td>
<td>10°</td>
</tr>
<tr>
<td>Fig. 6.</td>
<td>4°</td>
</tr>
</tbody>
</table>

Total Tilt 6

Item 2 Design Missing (Score 10 each) Fig. 6.  10
Item 3 Circles Touching (Score 6)
Item 4 Separated by Lines (Score 10)  10
Item 5 Second Attempt (Score 4 each)
Item 6 Additional Marks (Score 10) Fig. 2.  10
Item 7 Numbering (Score 6)
Item 8 Distortion (Score 8 each)
Item 9 Stretching (Score 4 each)
Item 10 Breakage (Score 6 for each figure in which breakage occurs.)
Item 11 Tremor (Score 8)

Total Score 36
SCREENING SCALE B
(Neurological Referral)

Item 1: Turning of Grasping, Finger to Nose (score 0-10)
Item 2: Cogitation (score 0)
Item 3: Fragmentation (score 0-10)
Item 4: Suppression (score 0)
Item 5: Relative Size (score 0-10)
Item 6: Unsteadiness (score 0-10)
Item 7: Covering (score 0-10)
Item 8: Orientation (score 0-6 each)
Item 9: Sensory Diminution (score 0-10 each)
Item 10: Sensory Measure (score 0-10 each)
Item 11: Fragmentations: Tear-Making Test. Part A or Part B (score 0-20)

Step 12: A) 0 refers to Tear-Making Test, Part A and B. 100% score of 0 or below
         (score 0-20 only for A, B, or A plus B)
PLATE 24. SCREENING SCALE B  
(Neurological Referral)

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item 1</td>
<td>Loss of Directionality</td>
<td></td>
</tr>
<tr>
<td>Item 2</td>
<td>Turning of Protocol</td>
<td></td>
</tr>
<tr>
<td>Item 3</td>
<td>Circles</td>
<td></td>
</tr>
<tr>
<td>Item 4</td>
<td>Fragmentation</td>
<td></td>
</tr>
<tr>
<td>Item 5</td>
<td>Compression</td>
<td></td>
</tr>
<tr>
<td>Item 6</td>
<td>Relative Size</td>
<td></td>
</tr>
<tr>
<td>Item 7</td>
<td>Unevenness</td>
<td></td>
</tr>
<tr>
<td>Item 8</td>
<td>Covering</td>
<td></td>
</tr>
<tr>
<td>Item 9</td>
<td>Distortion</td>
<td></td>
</tr>
<tr>
<td>Item 10</td>
<td>Design Missing</td>
<td></td>
</tr>
<tr>
<td>Item 11</td>
<td>Fragmentation: Trail Making Test Part A or Part B</td>
<td></td>
</tr>
</tbody>
</table>
| Item 12| A) 6 errors on Trail Making Test, Part B  
B) SAET score of 4 or below  
(score 20 only for A, B, or A plus B) |       |

Total Score
Screening Scale B  
(Neurological Referral)

In scoring, although an item such as Item 1, Loss of Directionality, should occur in more than one figure, it is scored only once for the protocol unless it is specifically indicated otherwise. In such instances this is stated in parentheses.

Item 1 Loss of Directionality (score 8)

Loss of Directionality usually occurs in reproductions of figures 4, 6, 7 and 8. It may be described as the loss of control and recovery of the direction which it is necessary for the subject to maintain in order to complete the figure. The results are sometimes crude and often Distortion must also be scored.
PLATE 25. Item 1 Loss of Directionality

Fig. 4

Fig. 6
Fig. 8
Screening Scale B

Item 2 Turning of Protocol (score 10)

Turning of Protocol is scored when the subject rotates the protocol to the horizontal position, upside down, or around several times placing figures wherever they fit in, in what seems to be an attempt to fit all the reproductions on one page.

Thus if the subject rotates the paper and reproduces a figure on another axis, the item is scored. An illustration is not necessary.
Screening Scale B

Item 3  **Circles** (score 4)

This item is scored when the subject substitutes circles for dots in Figures 1, 3 or 5. This is also scored when the reproduction of the figure starts with dots but is completed with circles.
Fig. 1

Fig. 3

PLATE 28. Item 3 Circles
PLATE 29. Item 3 Circles

Fig. 5

Drawn when the free space of the figure was not occupied by the symbols noted in the reproduction. It is an exact copy of drawings traced in a meeting note. To prevent any area from being viewed in the reproduction in scale of 1. It is reduced to Figure 5 by a factor of 7.

Fig. 6 Shown when the 320A are not used.

Fig. 7 Shown when the 420A are not used.
Screening Scale B

Item 4 Fragmentation (score 10)

Fragmentation is scored when the figures are separated into distinct parts in the reproduction. It is an extreme form of breakage, scored in Screening Scale A. However, some figures may be scored Breakage in Scale A and Fragmentation in Scale B. It is scored in Figures 2, 3, 4, 5, 6 and 7.

Fig. 2 Scored when the design is broken and placed on two levels.

Fig. 3 Scored when there is an extreme break in the distance between the rows of dots.

Fig. 4 Scored when the two parts of the figures are separated by at least 1/3 the length of the base line in the box-like figure.

Fig. 5 Scored when the tail is separated from the arc by at least the distance between the first two dots following the break, measured separately and added together.

Fig. 6 Scored when the lines do not cross.

Fig. 7 Scored when the two hexagons do not overlap.
Fig. 2

Fig. 3
Plate 31. Item 4 Fragmentation

Fig. 4

Fig. 5

Fig. 6
PLATE 32. Item 4 Fragmentation

Fig. 7
Screening Scale B

Item 5  **Compression** (score 4)

This item is scored by Pascal and Suttell's method. "The item is scored when the reproductions are compressed to cover approximately one-half of the page, whether the half used is the top, middle, right or left half." No illustration is necessary.
Screening Scale B

Item 6 Relative Size (score 10)

This item is scored by Pascal and Suttell's method. "The item is scored when there occurs pronounced variations in the size of the reproductions. The deviation is scorabe even when only one of the designs is disproportionately compressed or expanded."
PLATE 33. Item 6 Relative Size

Despite its tiny size, it is only seen when one of the figures, usually the first, is represented as lightly on the paper that it is difficult to see as it is surrounded by the other figures on the document.
Screening Scale B

Item 7  Unevenness (score 10)

This item rarely occurs. It is only scored when one of the figures, usually the first, is reproduced so lightly on the paper that it is difficult to see it in comparison to the other figures in the protocol.
PLATE 34. Item 7 Unevenness

[Diagram with handwritten notes and symbols]
Screening Scale B

Item 8  **Covering** (score 10)

This is scored when one figure is reproduced on top of or across another figure. It is more severe than the "overlapping of designs" scored by Pascal and Suttell in which only small portions of figures run into or slightly overrun each other.
Item 9  **Distortion** (score 6 each)

This item is scored as in Screening Scale A.
Screening Scale B

Item 10  **Design Missing** (score 10 each)

This item is scored as in Screening Scale A.

---

**Part A**

This occurs when the subject, rather than linking the numbered and lettered circles in the sequence, displays either skipping numbers four and five, number seven and number eight, number thirteen and number fourteen, or number thirteen and number fourteen. Thus the subject breaks the pattern into small units.

---

**Part B**

This occurs when the subject, rather than linking the numbered and lettered circles in alternating, ascending sequence, links individual sequences, for example, number four with letter B, number five with letter N, or number ten with letter J, thus breaking the pattern into small units.

Note: The item is scored whether or not the correct sequences are linked.
Screening Scale B

Item 11 Fragmentation: Trail Making Test

Part A or Part B (score 20)

Part A This occurs when the subject, rather than linking the numbered circles in the sequence from 1 to 25, links individual sequences. Examples are: linking number four and number five, number seven and number eight, or number thirteen and number fourteen. Thus the subject breaks the pattern into small units.

Part B This occurs when the subject, rather than linking the numbered and lettered circles in alternating, ascending sequence, links individual sequences, for example, number four with letter D, number five with letter E, or number ten with letter J, thus breaking the pattern into small units.

Note: The item is scored whether or not the correct sequences are linked.
Trail Making Part A

PLATE 36.

Screening Scale B Item 11 Fragmentation

Diagram of connections between numbers 1 to 25.
Screening Scale B

Item 12 Errors on TMT-B or SAET (score 20)

This item is scored when the subject has made 6 errors on Part B of the TMT, or has received a score of 4 or below on the SAET, or both.
### Screening Scale B. (Neurological Referral)

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item 1</td>
<td>Loss of directionality (Score 8)</td>
<td></td>
</tr>
<tr>
<td>Item 2</td>
<td>Turning of Protocol (Score 10)</td>
<td>10</td>
</tr>
<tr>
<td>Item 3</td>
<td>Circles (Score 4)</td>
<td></td>
</tr>
<tr>
<td>Item 4</td>
<td>Fragmentation (Score 10) Fig. 6.</td>
<td>10</td>
</tr>
<tr>
<td>Item 5</td>
<td>Compression (Score 4)</td>
<td></td>
</tr>
<tr>
<td>Item 6</td>
<td>Relative Size (Score 10) Fig. 1.</td>
<td>10</td>
</tr>
<tr>
<td>Item 7</td>
<td>Unevenness (Score 10)</td>
<td></td>
</tr>
<tr>
<td>Item 8</td>
<td>Covering (Score 10) Fig. 2 &amp; 6</td>
<td>10</td>
</tr>
<tr>
<td>Item 9</td>
<td>Distortion (Score 6 each) Fig. 3 &amp; 6</td>
<td>12</td>
</tr>
<tr>
<td>Item 10</td>
<td>Design Missing (Score 10 each)</td>
<td></td>
</tr>
<tr>
<td>Item 11</td>
<td>Fragmentation: Trail Making Test Part A or Part B (Score 20)</td>
<td></td>
</tr>
<tr>
<td>Item 12</td>
<td>A) 5 errors on Trail Making-Part B</td>
<td></td>
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<tr>
<td></td>
<td>B) SANE score of 4 or below.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Score 20 only for A, B, or A + B)</td>
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**Total Score**: 72
PLATE 40. SCORING ILLUSTRATION
<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Score</th>
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</thead>
<tbody>
<tr>
<td>Item 1</td>
<td>Loss of directionality (score 8) Figs. 7, 8.</td>
<td>8</td>
</tr>
<tr>
<td>Item 2</td>
<td>Turning of Protocol (Score 10)</td>
<td></td>
</tr>
<tr>
<td>Item 3</td>
<td>Circles (Score 4)</td>
<td>4</td>
</tr>
<tr>
<td>Item 4</td>
<td>Fragmentation (Score 10)</td>
<td></td>
</tr>
<tr>
<td>Item 5</td>
<td>Compression (Score 4.)</td>
<td></td>
</tr>
<tr>
<td>Item 6</td>
<td>Relative Size (Score 10)</td>
<td></td>
</tr>
<tr>
<td>Item 7</td>
<td>Unevenness (Score 10)</td>
<td></td>
</tr>
<tr>
<td>Item 8</td>
<td>Covering (Score 10) Figs. 1, 2, 6</td>
<td>10</td>
</tr>
<tr>
<td>Item 9</td>
<td>Distortion (Score 6 each) Figs. 7</td>
<td>6</td>
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<tr>
<td>Item 10</td>
<td>Design Missing (Score 10 each)</td>
<td></td>
</tr>
<tr>
<td>Item 11</td>
<td>Fragmentation: Trail Making Test Part A or Part B (Score 20)</td>
<td></td>
</tr>
<tr>
<td>Item 12</td>
<td>A) 6 errors on Trail Making-Part B / B) SAST score of 4 or below. (Score 20 only for A, B, or A + B)</td>
<td>20</td>
</tr>
</tbody>
</table>

Total Score 48
Chapter 8

RESULTS OBTAINED WHEN SCREENING SCALE A AND SCREENING SCALE B WERE APPLIED TO THE DATA

I. Results Obtained with Screening Scale A (Emotional Disturbance)

A. The Normal and Emotionally Disturbed Groups

When the Bender-Gestalt protocols of the Emotionally Disturbed Group were scored by Screening Scale A, a mean score of 30.83 was obtained with a range from 0 to 70. The difference between the means of the two groups was significant at the .1% level (See Tables 15 and 16). The mean score for the Cerebral Dysfunction Group was 50.91 with a standard deviation of 31.98.

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>200</td>
<td>11.42</td>
<td>10.57</td>
</tr>
<tr>
<td>Emotionally Disturbed</td>
<td>60</td>
<td>30.83</td>
<td>18.03</td>
</tr>
<tr>
<td>Cerebral Dysfunction</td>
<td>39</td>
<td>50.91</td>
<td>31.98</td>
</tr>
</tbody>
</table>
TABLE 16

Screening Scale A: Significance of Differences between Mean Scores of the Groups

<table>
<thead>
<tr>
<th>Groups</th>
<th>Value of t</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normals and Emotionally Disturbed</td>
<td>7.91</td>
<td>.001</td>
</tr>
<tr>
<td>Normals and Cerebral Dysfunction</td>
<td>4.09</td>
<td>.001</td>
</tr>
<tr>
<td>Cerebral Dysfunction and Emotionally Disturbed</td>
<td>3.53</td>
<td>.001</td>
</tr>
</tbody>
</table>

1. Maturational Effects

In order to determine maturational effects, the mean scores for each age level within the Normal Group were compared with the ten-year-old-mean. Although no significant difference was obtained between the ten and eleven-year-olds, with an increase in chronological age, there was an increase in the significance of differences between the means of the age groups and the ten-year-olds. (See Table 17). When the emotionally disturbed and normals were compared at each age level, the weakest age was ten years, although the difference between the means of the ten-year-old emotionally disturbed and the ten-year-old normals was significant at the 1% level. At ages eleven through fourteen, the differences in the mean scores were significant at the .1% level (See Table 18). Figure 4
indicates that maturational effect was consistent in the Normal Group, but much less so in the Emotionally Disturbed Group. Thus, in a sense, with age the normals moved further away from the typical emotionally disturbed score.

**TABLE 17**

Screening Scale A: Significance of Differences between Means at each Age Level within the Normal Group

<table>
<thead>
<tr>
<th>Groups</th>
<th>Value of t</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ten-year-olds and eleven-year-olds</td>
<td>1.02</td>
<td>&gt; .05</td>
</tr>
<tr>
<td>Ten-year-olds and twelve-year-olds</td>
<td>2.41</td>
<td>&lt; .05</td>
</tr>
<tr>
<td>Ten-year-olds and thirteen-year-olds</td>
<td>5.60</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>Ten-year-olds and fourteen-year-olds</td>
<td>7.90</td>
<td>&lt; .001</td>
</tr>
</tbody>
</table>

**TABLE 18**

Screening Scale A: Significance of Differences between Means of the Normal and Emotionally Disturbed Groups at each Age Level

<table>
<thead>
<tr>
<th>Groups</th>
<th>Value of t</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ten-year-old Normals and ten-year-old Emotionally Disturbed</td>
<td>3.05</td>
<td>&lt; .01</td>
</tr>
<tr>
<td>Eleven-year-old Normals and eleven-year-old Emotionally Disturbed</td>
<td>3.94</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>Twelve-year-old Normals and twelve-year-old Emotionally Disturbed</td>
<td>5.65</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>Thirteen-year-old Normals and thirteen-year-old Emotionally Disturbed</td>
<td>6.01</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>Fourteen-year-old Normals and fourteen-year-old Emotionally Disturbed</td>
<td>8.06</td>
<td>&lt; .001</td>
</tr>
</tbody>
</table>
Figure 4. Scale A: Normal and Emotionally Disturbed Scores at Each Age Level
2. The Items in Screening Scale A

Chi Squares on the eleven items in Scale A indicated that nine of the items significantly differentiated the Emotionally Disturbed from the Normal Group (See Table 19). Only Item 5, Second Attempt, and Item 7, Numbering, failed to make the discrimination. The most significant items \( (P < .001) \) were Tilt, Circles Touching, Separation by Lines, and Additional Marks.

**TABLE 19**

Association between Items of Screening Scale A and Emotionally Disturbed Group

<table>
<thead>
<tr>
<th>Item</th>
<th>( X^2 )</th>
<th>( P )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Tilt</td>
<td>34.63</td>
<td>(&lt; .001)</td>
</tr>
<tr>
<td>2. Design missing</td>
<td>7.28</td>
<td>(&lt; .01)</td>
</tr>
<tr>
<td>3. Circles touching</td>
<td>16.64</td>
<td>(&lt; .001)</td>
</tr>
<tr>
<td>4. Separation by lines</td>
<td>12.48</td>
<td>(&lt; .001)</td>
</tr>
<tr>
<td>5. Second attempt</td>
<td>.052</td>
<td>....</td>
</tr>
<tr>
<td>6. Additional marks</td>
<td>11.67</td>
<td>(&lt; .001)</td>
</tr>
<tr>
<td>7. Numbering</td>
<td>1.56</td>
<td>....</td>
</tr>
<tr>
<td>8. Distortion</td>
<td>6.24</td>
<td>(&lt; .02)</td>
</tr>
<tr>
<td>9. Stretching</td>
<td>3.90</td>
<td>(&lt; .05)</td>
</tr>
<tr>
<td>10. Breakage</td>
<td>10.66</td>
<td>(&lt; .01)</td>
</tr>
<tr>
<td>11. Tremor</td>
<td>5.72</td>
<td>(&lt; .02)</td>
</tr>
</tbody>
</table>

1 2 X 2 tables of the frequency of children in each group showing the presence or absence of the item in the protocol.
One can only speculate as to what the items which were found to be statistically significant in Screening Scale A are measuring. The writer tentatively suggests that many of these items revolve around loss of control and attempts to maintain control, both of which are common problems with emotionally disturbed children.

Item 1  Tilt

This factor ties in with the conjecture of loss of control. Fabian (23) theorizes that rotation, which is what Tilt is measuring to a lesser degree, is a persistent feature of visual-motor performance which is inhibited, but not overcome, as the individual advances in age. Thus, the failure or breaking down of the inhibition could be considered loss of control which one could expect to find more prevalent in the Emotionally Disturbed than in the Normal Group.

Item 2  Design Missing

There are possibly many dynamics which could contribute to this deviation, the one utilized depending on the need of the subject. The writer can only offer a few possibilities; loss of psychic energy, castration anxiety, trauma produced by the phallic symbolism of some of the figures, hostility, or delusions about the testing situation or the Examiner.
Item 3  **Circles Touching**

This, as Item 2, can possibly be produced by different dynamics in different individuals. When it occurs in Figures 3 and 5, it may indicate more loss of control than when it occurs only in Figure 2, since substitution of circles for dots is necessary before the deviation can occur. It may be an indication of immaturity and dependency needs, while it contains elements of perseveration when it occurs in more than one figure.

**Item 4  Separation by Lines**

Hutt's (49) interpretation of this phenomenon would be that the lines are indicative of the subject's feelings of inadequacy and isolation. However, they could also be indicative of compulsiveness, meticulousness, the subject's need to structure his situation or an attempt to remedy his perceived shortcomings.

**Item 6  Additional Marks**

This deviation seems to indicate mainly loss of control and in some instances impulsivity. Further dynamics which it may be tapping could be a need to control, hostility, and an attempt to take possession by leaving one's mark. With the severely ill, the marks may have esoteric meaning for the subject. Any attempt
at an interpretation would depend upon the nature of the additional mark or marks and the protocol per se.

Item 8 Distortion

It would seem that this item reflects loss of control with little, if any, recovery. Hutt (49) considers it a psychotic sign. The writer would suggest, as possibly would Pascal and Suttell (73), that it may be an indication of the intensity of the emotional disturbance. However, this would necessitate a subjective estimate and the remainder of the protocol would have to be taken into consideration.

Item 9 Stretching

This seems to be a perseverative phenomenon again suggesting loss of control which is usually terminated for the subject by his reproduction of the figure reaching the edge of the paper.

Item 10 Breakage

This item could be an indication of temporary immobilization or conflict, rather than loss of control, from which there is recovery and a continuation of the reproduction. It was noted in observing this phenomenon, that the subject usually paused momentarily in reproducing the stimulus figure and that the break was made upon renewal of the activity of reproducing the design.
Item 11  Tremor

This deviation is possibly a reflection of anxiety or tension. It could also be indicative of "pentup aggression" as Pascal and Suttell (73) claim.

B. Cutting Scores and Misclassification

When a cutting score of 20 was applied to the results obtained with Screening Scale A, 26 or 13% of the Normal Group and 9 or 15% of the Emotionally Disturbed Group were misclassified. The average misclassification was 14%. An attempt was then made to increase the efficiency of Scale A by establishing individual cutting scores at each age level (See Table 20).

These cutting scores reduced the number of misclassifications among the normals from 26 to 25 and among the emotionally disturbed from 9 to 4. The total misclassifications were reduced by the individual cutting scores from 35 to 29 or from an average misclassification of 14% to an average misclassification of 9.5%.

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1 p.93.

2 A similar attempt was made with the Pascal-Suttell scores at each age level. While this reduced the normal misclassifications to 20, it increased the misclassifications in the Emotionally Disturbed Group to 25. An attempt to find a cutting score for ages 10 and 11 grouped and ages 12, 13 and 14 grouped, also failed to increase the efficiency (See Appendix H).
In order to evaluate Scale A more thoroughly as a screening method, the verbatim notes taken from the records of the nine emotionally disturbed subjects whom the scale failed to identify when a single cutting score of 20 was used, were carefully perused. It was found that the group was composed of four fourteen-year-olds, three thirteen-year-olds, one twelve-year-old, and one ten-year-old. With the exception of one case which fell at the mean, the Pascal-Suttell method also failed to identify these children.
One child, a boy of fourteen years, had a series of convulsions at the age of three. His sister is epileptic and his mother is described as having "fits". The boy, together with his two brothers and two sisters, two half-brothers and three half-sisters, was placed by the authorities when the family disintegrated as the result of the mother's imprisonment and the father's abandonment of the children. Thus there is the possibility that this boy is an idiopathic epileptic who was placed for his own protection rather than for treatment. He was making an adequate adjustment to his peers in the institution's school and was not receiving therapy. He would have been correctly classified using the 14 year cutting score.

Four subjects, all males, ages 10, 12, 13 and 14, are similar in that they all have over-anxious, hysterical mothers. Three of the boys had somatized their illnesses and each boy was receiving psychotherapy. The somatization plus the support of psychotherapy may have contributed to their scores falling within the normal range, which suggests more ego strength than is generally found in the Emotionally Disturbed Group. Two of these subjects, the 12-year-old and the 13-year-old would have been correctly classified if the age level cutting scores had been
Two children, ages 13 and 14, were receiving psychotherapy as outpatients and both had been diagnosed as anxiety neuroses. The 14-year-old would have been correctly classified with the 14 year cutting score.

Of the remaining two children, one, a 14-year-old female, following early emotional deprivation, has been in a constant struggle with the parents, school and any person representing authority. She has had some psychotherapy and seems to have settled out for the present. She has adjusted well in a special class for the emotionally disturbed. She also would have been correctly classified with the 14 year cutting score.

The final child in this group is a thirteen-year-old boy who was in a special class for the emotionally disturbed. He presented no behaviour problems and was receiving psychotherapy because no physical basis could be found for his obesity. He would have been misclassified with either cutting score.

Thus one child could possibly have been excluded from the Emotionally Disturbed Group due to misplacement. The eight remaining children had received or were receiving some form of psychotherapeutic treatment, the support of which may have helped to stabilize them to
some degree and may have contributed to increased ego strength. It is impossible to say to what extent severity of illness distinguishes between the children in the Emotionally Disturbed Group.

Of the 26 children in the Normal Group whose scores fell within the emotionally disturbed range, 7 of them were described by their teachers as having Nuisance Value. In addition, another child, a ten-year-old boy, had been hit by a car and had suffered a long period of unconsciousness. He made high scores on all three scales; Pascal-Suttell, Scale A and Scale B. The only other child on whom notes were made, was an eleven-year-old boy. This boy used odd speech which seemed to border on verbigeration, became excited during the testing, and at times seemed rather impulsive. He, too, received high scores on all three scales.

If, for the sake of discussion, one could assume that these 9 children do suffer some degree of emotional disturbance, 17 of the 26 screened by the single cutting score of 20, apparently remain misclassified. However, Pascal and Suttell consider that 16% of the normal population can be expected to have some degree of psychiatric illness—a percentage which they claim is justified by empirical studies of the incidence of mental
illness. Hence, the 17 remaining children could be suspected of having some degree of emotional disturbance which has not been severe enough to occasion the child's withdrawal from normal education.

II. Results Obtained with Screening Scale B
(Neurological Referral)

A. The Normal and the Cerebral Dysfunction Groups

Screening Scale B when applied to the Cerebral Dysfunction Group obtained a mean score of 54.75 with a standard deviation of 32.12. The scores ranged from 0 to 139. Applied to the Normal Group, Scale B gave a mean of 4.95 with a standard deviation of 6.81. The scores ranged from 0 to 50. The difference between the means of the two groups was significant at the .1% level (See Tables 21 and 22).

<table>
<thead>
<tr>
<th>TABLE 21</th>
</tr>
</thead>
<tbody>
<tr>
<td>Means and Standard Deviations of Groups Scored by Screening Scale B</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>200</td>
<td>4.95</td>
<td>6.81</td>
</tr>
<tr>
<td>Emotionally Disturbed</td>
<td>60</td>
<td>13.33</td>
<td>13.22</td>
</tr>
<tr>
<td>Cerebral Dysfunction</td>
<td>39</td>
<td>54.80</td>
<td>32.12</td>
</tr>
</tbody>
</table>

1 The Ministry of Health in a letter to the writer stated that as of 31st December, 1961, 2.5 children per thousand aged under 16 were either in hospital or known to local health authorities as mentally disordered.
TABLE 22

Difference Between Mean Screening Scale B Scores of the Groups

<table>
<thead>
<tr>
<th>Groups</th>
<th>Value of t</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normals and Cerebral Dysfunction</td>
<td>9.53</td>
<td>.001</td>
</tr>
<tr>
<td>Normals and Emotionally Disturbed</td>
<td>4.70</td>
<td>.001</td>
</tr>
<tr>
<td>Cerebral Dysfunction and Emotionally Disturbed</td>
<td>7.56</td>
<td>.001</td>
</tr>
</tbody>
</table>

1. Maturational Effects

Although there was a consistent lowering of the mean scores at the age levels from ten through thirteen years within the normal group, there was no significant difference when ascending age levels were compared (See Tables 23 and 24). Thus, although maturational factors are probably present, they are possibly more gradual than those which would be reflected if measured at yearly intervals.

TABLE 23

Scale B: Age Level Means in the Normal Group (ungrouped)

<table>
<thead>
<tr>
<th>Age Level</th>
<th>N</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ten-year-olds</td>
<td>39</td>
<td>6.87</td>
</tr>
<tr>
<td>Eleven-year-olds</td>
<td>42</td>
<td>4.42</td>
</tr>
<tr>
<td>Twelve-year-olds</td>
<td>35</td>
<td>3.14</td>
</tr>
<tr>
<td>Thirteen-year-olds</td>
<td>48</td>
<td>1.70</td>
</tr>
<tr>
<td>Fourteen-year-olds</td>
<td>36</td>
<td>2.66</td>
</tr>
</tbody>
</table>
TABLE 24

Scale B: Significance of Difference Between Means at Ascending Age Levels in the Normal Group

<table>
<thead>
<tr>
<th>Ages</th>
<th>t</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 years and 11 years</td>
<td>1.09</td>
<td>N.S.</td>
</tr>
<tr>
<td>11 years and 12 years</td>
<td>.8</td>
<td>N.S.</td>
</tr>
<tr>
<td>12 years and 13 years</td>
<td>1.55</td>
<td>N.S.</td>
</tr>
<tr>
<td>13 years and 14 years</td>
<td>.43</td>
<td>N.S.</td>
</tr>
</tbody>
</table>

In consideration of the Cerebral Dysfunction Group, the different diagnostic categories within each age level, together with the limited number of children at each age, make an adequate statistical comparison impracticable (See Table 25). However, a review of the scores and diagnoses at each age level (See Appendix F) suggests that the high ten-year mean may be due to maturational factors as well as illness, while the high twelve-year mean may possibly be due more to illness.

TABLE 25

Scale B: Age Level Means in the Cerebral Dysfunction Group

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ten-year-olds</td>
<td>6</td>
<td>75.1</td>
</tr>
<tr>
<td>Eleven-year-olds</td>
<td>9</td>
<td>51.5</td>
</tr>
<tr>
<td>Twelve-year-olds</td>
<td>9</td>
<td>64.1</td>
</tr>
<tr>
<td>Thirteen-year-olds</td>
<td>7</td>
<td>44.2</td>
</tr>
<tr>
<td>Fourteen-year-olds</td>
<td>8</td>
<td>34.7</td>
</tr>
</tbody>
</table>
2. The Items in Screening Scale B

Chi Squares on each of the twelve items which comprise Screening Scale B indicated that each item, with the exception of Item 5, Compression, was significant at the .1% level (See Table 26).

The writer can again only speculate as to what the items which comprise Scale B are measuring. It would seem that the majority of the items revolve around a few psychopathological characteristics which are common to some extent in most children suffering cerebral dysfunction. These characteristics, which naturally are not all present in each protocol, are fixation and perseveration, forced responsiveness to stimuli, meticulousness and pedantry, substitute activity, and fluctuations of reactions.

Item 1 Loss of Directionality

A rather common feature of the reproductions scored for Loss of Directionality is their angularity at points of loss and recovery in contrast to the less angular features evident in gross tremor. Thus, the question arises whether the phenomenon is due to perceptual defect or if it is the function of a motor defect. Klebanoff (56) suggests that errors may be due to some motor or apractic defect related to pathological involvement of the motor cortex. Quast (30) mentions patients describing their inability to make an angle in one
TABLE 26

$x^2$'s of Items Incorporated in Screening Scale B

<table>
<thead>
<tr>
<th>Item</th>
<th>$X^2$</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Loss of directionality</td>
<td>72.39</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>2. Turning of protocol</td>
<td>36.97</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>3. Circles</td>
<td>18.68</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>4. Fragmentation</td>
<td>104.99</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>5. Compression</td>
<td>1.95</td>
<td></td>
</tr>
<tr>
<td>6. Relative size</td>
<td>28.08</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>7. Unevenness</td>
<td>37.18</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>8. Covering</td>
<td>30.71</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>9. Distortion</td>
<td>65.15</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>10. Design missing</td>
<td>39.45</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>11. Fragmentation TMT</td>
<td>26.17</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>12. SAET or TMT-B score</td>
<td>111.03</td>
<td>&lt; .001</td>
</tr>
</tbody>
</table>

1 $2 \times 2$ tables of the frequency of children in each group showing the presence or absence of the item in the protocol.

direction, while they can execute it rather easily in another. He suggests that defects in cortical sensory or motor areas are "instrumental prerequisites" of this difficulty in laterality. The latter could account for

\[ p.408. \]
the several rather unsuccessful attempts to change the direction of the line which are often seen in Loss of Directionality. Landmark (61) believes that there is an interaction between perception and construction and that perception is not independent of form construction. Thus, the inability to copy a design is not necessarily an expression of deficient visualization but rather a weakness of spatial expression.

Item 2 Turning of Protocol

There is probably no specific explanation for this phenomenon, but more likely several different combinations which could trigger it off and keep it going. The first time that a figure is placed or worked into a position on another axis of the protocol, it may be due to the child's rigidity or meticulousness in that he must have all of the figures on one side of one sheet of paper. In this, there may also be an element of an intense desire to succeed, which Klopfer and Kelly (57) describe in adults. This phenomenon does not usually occur until the protocol is quite covered with figures. Finally, some element of perseveration may be operating if the child continues to fit his figures in on different axes of the protocol. Hutt (49), speaking of adults, claims that this is almost
always found in egocentric individuals and that if the protocol is turned all of the way around it is indicative of oppositional tendencies.

Item 3 Circles

This is probably a form of perseveration when it occurs in Figure 3 and iterative perseveration when it occurs in Figure 5. Both Strauss and Kephart (102) and Goldstein (33) describe this phenomenon as difficulty or the inability to shift, i.e., to revise or change the response to meet the condition of the new stimulus. Further, it is a substitution in that a simplified response is substituted which at the same time is relevant to the demand of the stimulus.

Item 4 Fragmentation

In most instances of Fragmentation, the fragmented parts are left intact, i.e., remain in relationship to each other but are separated off from other parts. This may be due to several traits which are often found in the child suffering cerebral dysfunction. First, it may arise from the child's difficulty in organizing parts into wholes; also the child may be less aware of the total figure than of its stimulus parts. Second, the child, having reproduced a part of the stimulus figure and being unable to integrate it into the remainder of the figure, treats it in a rather
meticulous manner and completes the part. He then may
treat the other part in the same way. This may contain
elements of forced responsiveness to stimuli. Strauss
and Werner (103) believe that meticulous or orderly
behaviour is the child's method of defending himself against
dissociation, while Goldstein (33) suggests it is a defense
against catastrophic reaction.

Item 5 Relative Size

It is difficult to account for this phenomenon. One
suggestion is that the symbolic content or meaning of the
figure to the child may cause him to act out in the sense
that he greatly enlarges or reduces his reproduction of
the figure in relation to other figures in the protocol.
This might come under the category of fluctuations in
reactions. It could also possibly be due to instability
in the visual cortex resulting in shifts in size constancy.

Item 7 Unevenness

This only occurred once in a figure other than the
first in the data, and this was in Figure 5. In instances
when it occurred in the first figure, it was possibly due
to the subject's feelings of inadequacy because he was not
sure what was expected of him. Or, it could have been due
to a poverty of impulses at the moment. Thus, the subject
reproduced the figure hesitantly and lightly. Then, having
gained confidence from the Examiner's acceptance of his
first reproduction, the second was reproduced with normal pressure. Since the first reproduction was so difficult to see, it probably did not offer enough further stimulation to the subject, if he scanned back over the protocol, to cause him to retrace it. The same general suggestions could be responsible when Unevenness occurred in other figures, if for some reason, the subject felt incapable of reproducing them. The act of producing a very lightly drawn figure could be a form of substitute activity.

Item 8 Covering

Covering often occurs together with Item 7, Unevenness, in that the subject places another reproduction over his reproduction of Figure 1. This is possibly again due to the fact that the uneven figure does not offer enough stimulus for the subject to be attracted by it.

The phenomenon could also be produced by the subject's inability to shift, i.e., once the direction of the figure has been set into motion, the subject may not be able to change it even though the result will be to run across another figure.

Stainbrook and Lowenbach (97) speak of a form of perseveration evident in agraphia in which some observers described the hand of the subject as compulsively moved toward the area of the optic stimulus and that this stimulus
restricted the hand to that spot. Some form of this type of perseveration may account for the phenomenon of covering, but in this speculation the area of optic stimulus would of necessity have to be the figure about to be covered, which is contradictory to the first suggestion, i.e., lack of stimulus value in the first figure.

Item 9 Distortion

Hutt (49), in speaking of adults, considers Distortion of a reproduction "...PRI MA FACIE evidence of a psychotic process, even though the personality structure of the subject may not altogether be that of a psychotic individual."¹

In children suffering some degree of cerebral dysfunction Distortion in reproductions of the Bender-Gestalt figures may arise from a number of dynamics. It may result from difficulty in laterality which together with pedantry and meticulous could produce a completed but inadequate and distorted reproduction. Other contributing factors could be difficulty with the figure-background relationships, the background being increased each time a reproduction is added to the protocol, or the child could become stimulus bound to certain areas of the figure. Finally, a distorted reproduction may be the best the

¹ pp.674-675.
child can produce, i.e., a substitute, albeit inadequate, since he cannot achieve the requested reproduction. The writer does not agree that this phenomenon is necessarily indicative of a psychotic process in the child suffering some degree of cerebral dysfunction.

Item 10 **Design Missing**

Some of the underlying dynamics contributing to Design Missing are possibly similar to those contributing to Item 9, Distortion. However, Design Missing usually involves a simplification of the child's reproduction because of his inability to meet the request which is too difficult for him. Emotional factors such as loss of psychic energy, castration anxiety, trauma produced by phallic symbolism, or hostility, may also contribute to this phenomenon.

Item 11 **Fragmentation TMT A or B**

This phenomenon is possibly a compensatory reaction in that the child substitutes a simpler, but appropriate function for the more difficult one which is requested. This could be brought about by the child's attempt to structure the perceptual field. In some instances, perseveration can result when the child discontinues connecting logical sequences and substitutes connecting circles at random. This may be brought on by the child's loss of control in structuring the field and his resorting to responses which worked before, although they are no longer appropriate.
Item 12  Score TMT-B or 4 or lower score SAET

Although one cannot be certain that the TMT-B is tapping factors related to cerebral dysfunction, it was included in Scale B because there was a highly significant difference ($P < .001$) between the mean scores of the Cerebral Dysfunction and the Emotionally Disturbed Groups, as well as between the Cerebral Dysfunction and Normal Groups. In contrast, the Normal and Emotionally Disturbed Groups appeared relatively free from these factors. There was no significant difference between their means.

A score of 4 or below on the SAET was utilized in Scale B because of the highly significant difference ($P < .001$) between the means of the Cerebral Dysfunction and the Normal Groups. The mean score for the Normals was 7.51, while the mean score for the Cerebral Dysfunction Group was 4.89. The lower score of 4 was utilized in an attempt to screen off those subjects who had the greatest difficulty with the test, i.e., who did not perceive the afterimage following cessation of rotation.

B. Cutting Scores and Misclassification

The best cutting score that could be obtained for Screening Scale B was 14 (See Appendix H). When this was applied to the data 17 or 8.5% of the normals were misclassified, while 4 or 10.2% of the Cerebral Dysfunction
Group were misclassified. The total average misclassification was 9.3%. Since there was no significance between the age level means when they were compared in ascending order and since there were limited numbers and mixed diagnoses at each age level within the Cerebral Dysfunction Group, cutting scores at each age level were not obtained.

In reviewing the four records of the subjects in the Cerebral Dysfunction Group which Scale B failed to identify, it was found that there were three males, one age thirteen, two age fourteen, and one eleven-year-old female.

In the case of the female, the presenting problem was epilepsy, while the record contained a contrary diagnostic opinion of hysteria.

The thirteen-year-old male suffered a skull fracture resulting in convulsions and initial deterioration. However, there has been a remarkable recovery of his abilities within the past two years.

The writer cannot account for the excellent performance of the other two fourteen-year-old males. Their EEGs were described as mild, generalized abnormalities, although both subjects have suffered seizures from early childhood. Gallese (26) observed in studying idiopathic convulsive disorders that those organics "...diagnosed as acute and chronic brain syndromes associated with...idiopathic
convulsive disorders tended to perform very much more like normals than like the other organics". Thus one suspects that subjects with idiopathic convulsive disorders in which the EEG indicates a mild, generalized abnormality, cannot be readily detected by Scale B.

Of the 17 children, or 8.5% of the Normal Group whose scores fell at or above the cutting score of 14, one child was described as a severe nuisance by the teacher because of his hyperactivity. Another, previously mentioned, was hit by an automobile and suffered a period of unconsciousness. Fifteen children, or 7.5% of the normals who fell *above* the cutting score, cannot be accounted for by the writer. They have apparently gone unnoticed in the classroom. 2

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1 p. 256.
2 Children with controlled epilepsy or with mild degrees of spastic involvement would be in normal classrooms. The writer did not have access to the medical records, which in any case might not have contained the necessary information.
Chapter 9

CONCLUSIONS

I. Introduction

Pascal and Suttell (73) describe their scores as lying on a quantitative continuum; the continuum correlating, "...with a progression from less to greater psychological disturbance". Then, limiting their definition of ego functioning to the ability to reproduce adequately the Bender-Gestalt figure, they consider the position of a score on the continuum as an indicator of ego strength. Low scores are considered indicative of high ego strength and high scores of poor ego strength. They suggest that although norms are not available, their method of scoring and the raw scores obtained could be used for comparison purposes with individuals outside of their normative population. The writer has utilized the results of their scoring method with the populations in the present study for comparison with the results obtained with Screening Scale A and Screening Scale B.

The method and administration time for the Bender-Gestalt Test using Scales A and B or the Pascal-Suttell method are identical. However, if Scale B is to be utilized, the SAET and the TMT must be administered

1 p.9.
together with the Bender-Gestalt Test. Yet, with these adjuncts, a more reliable screening technique is made available than if the Bender-Gestalt were used singly.

In scoring, the A and B Scale methods are simpler than the method advocated by Pascal and Suttell. In Scale A, 11 items must be scored, while in Scale B there are 12 items. In the Pascal-Suttell method it is necessary to score a total of 105 items and then to convert the raw score to a Z score. Their scoring system is occasionally difficult to follow because of inconsistencies in their demonstrations and occasional vagueness as to what constitutes scorables items. They possibly referred to the latter when they wrote, "Our scoring system is, however, partly subjective in the sense that the scoring of some items is a matter of judgment."  

II. Screening Scales A and B versus the Pascal-Suttell Method

A. Scale A (Emotional Disturbance) versus the Pascal-Suttell Method

The difference between the means of the Normal and Emotionally Disturbed Groups was significant at the .1% level for both the Pascal-Suttell raw scores and for the scores obtained with Screening Scale A. However, when the best cutting score, or 44 was applied to the Pascal-Suttell raw scores, 45 subjects or 22.5% of the Normal Group fall

1p.28
above this score, while 21 subjects or 35% of the Emotionally Disturbed Group fell below it. Thus, the Pascal-Suttell method misclassified 66 subjects or an average of 28.8% of the combined populations. (See Figs. 5 & 6)

In contrast, when a cutting score of 20 was applied to the Scale A data, 26 or 13% of the normals fell above the cut, while 9 or 15% of the Emotionally Disturbed Group fell below it. Further, when age level cutting scores were utilized, 25 or 12.5% of the Normal Group were misclassified, while 4 or 6.6% of the Emotionally Disturbed Group were misclassified. Thus, by this method, the total average misclassification was reduced to 9.5%. Thus, Scale A misclassified 35 subjects or an average of 14% of the combined populations. Finally, the Pascal-Suttell method misclassified approximately 7 out of every 20 emotionally disturbed subjects, while Scale A misclassified approximately 3 out of every 20 emotionally disturbed subjects. Age level cutting scores further reduced this loss to 4 out of 60 emotionally disturbed subjects.

B. Scale B (Neurological Referral) versus the Pascal-Suttell Method

Both the Pascal-Suttell method and Screening Scale B obtained a difference between the means of the Cerebral Dysfunction Group and the Normal Group which was significant at the .1% level of confidence.
Figure 5. Ogives: Scale A Scores of the Three Groups

- Normal Group $N=200$
- Emotionally Disturbed Group $N=60$
- Cerebral Dysfunction Group $N=39$
The cutting score which seemed to make the best use of the Pascal-Suttell scoring method was 59. Applying this to the data, 10 or 5% of the normals were misclassified as suffering some degree of cerebral dysfunction, while 9 or 23.07% of the Cerebral Dysfunction Group were misclassified as normal. The total misclassification of the combined populations was 19 or an average of 14.03% (See Figs. 6 and 7).

When a cutting score of 14 was applied to the Scale B data, 17 or 8.5% of the normals were misclassified. However, only 4 or 10.2% of the children in the Cerebral Dysfunction Group obtained scores within the normal range. The total misclassification was 21 or an average misclassification of 9.3% for the combined populations.

In summary, the Pascal-Suttell method misclassified 9 out of 39 of the cerebral dysfunction children, while Screening Scale B misclassified 4 out of 39.

III. Discussion

In considering the previous attempts which have been made to render the Bender-Gestalt Test a useful psychodiagnostic technique (Billingslea (10), Gobetz (30), Hutt (49, 50), Byrd (13), Pascal and Suttell (73)), it seemed that these techniques had little practical value in return for the tremendous amount of time that the scoring necessitated. Further, much of the scoring could
be considered subjective and therefore difficult to communicate.\(^1\) Pascal and Suttell's scoring method was chosen by the writer as the one which is best validated and has the minimum of these weaknesses. However, it remains time-consuming in return for the amount of psychodiagnostic information it produces. Hence, the writer has attempted to utilize the Bender-Gestalt Test as a limited screening technique which should be followed up by further diagnostic evaluation in the area of emotional disturbance, cerebral dysfunction, or in some instances both.

When Screening Scale A (Emotional Disturbance), which has 94 fewer items to be scored than the Pascal-Suttell method, was applied to the data obtained from the Emotionally Disturbed and Normal Groups, the difference between the means was significant at the .1% level. Further, it misclassified approximately 7 out of 50 children in the combined populations, or approximately 1 out of 10 using the individual cutting scores, while the Pascal Suttell raw scores misclassified approximately 14 children out of 50.

Screening Scale B (Neurological Referral), which

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\(^1\) Following 3 hours of instruction, and practice scoring, a research student scoring 16 E.D. protocols and 16 cerebral dysfunction protocols, obtained coefficients of rel. of .88 and .93 respectively with the writer's scores.
has 73 less items to score than the Pascal-Suttell method, also differentiated between the means of the Cerebral Dysfunction and Normal Groups at the .1% level of confidence. When Scale B's ability to differentiate between the two groups was compared with that of the Pascal-Suttell scoring method, it was found that Scale B misclassified an average of 9 children out of 100, while the Pascal-Suttell method misclassified an average of 14 out of 100.

These findings suggest that Screening Scales A and B render the Bender-Gestalt Test a more effective screening technique than the Pascal-Suttell scoring method. The findings would also seem to justify cross-validation studies and research into what the significant items in both scales are measuring.
APPENDIX A. BILLINGSLEA'S FACTORS AND INDICES

Factors

1. ANGULATION: This term encompasses two conditions where angularity is the important factor.
   a. POINT ANGULATION (in Figures "a", 4, 7, and 8): The perceptual reproduction of the degree of angularity existing between two related angles in a figure's linear outline; i.e., the degree of relationship between Angles 1 and 2 of the diamond of Figure "a", the degree relationship between Angles "a" and "b" of the box of Figure 4, the degree relationship between Angles 3 and 6 of Figure 8.
   b. SLOPING ANGULATION (in Figures 2, 5, 6, 7): The perceptual reproduction of the deviation of one or more subparts of a figure from the figure's basic horizontal or vertical axis; i.e., the upper left to lower right slope of columns of circles in Figure 2, the upper right to lower left slope of the handle in Figure 5, the upper right to lower left slope of the left hand subpart in Figure 7.

2. CIRCULARITY (in Figure "a"): The perceptual reproduction of the circular form of the circle in Figure "a"; i.e., the ratio between the length of the horizontal diameter to the length of the vertical diameter of the circle.

3. CLOSURE (in Figures "a", 7, and 8): The perceptual reproduction of the connected but not overlapped linear joints in a figure or its subparts.

4. COLLIDING: The colliding or crossing of one figure reproduction on the test results sheets with one or more other figure reproductions on the same sheet.

5. COLUMNAR SPACING (in Figure 2): The perceptual reproduction of the distances existing between the columns of circles of Figure 2.

6. CONFABULATION. The substitution of numbers, letters, or peculiarly shaped symbols for the correct subparts of a figure; the dots or circles of the figure may be substituted, or the whole subpart or even the whole figure may be distorted into a peculiar shape so that its original gestalt form is destroyed and unrecognizable. This factor is not the same as Ornamentation.
7. CROSSING AVOIDANCE (Figure 6): The Fragmentation of the vertical or horizontal wavy lines, or of both wavy lines in such fashion that the two lines do not cross each other in Figure 6; the Left-Right Displacement of the vertical wavy line of Figure 6 to such a degree that it does not cross the horizontal line at any point.

8. DIRECTIONAL IRREGULARITY (Figures 1, 2, and 3): The tendency of one or more members of a row of columns of a figure to diverge either to the right of to the left of that row or column with the result that the row or column is not straight; rather, it gives the appearance of "irregularity," of "poor visual-motor control." Sometimes this divergence is such as to bow or curve a line that is straight in the standard cards. This factor may be related to, but cannot be said to be synonymous with motor incoordination.

9. ELONGATION (Figures "a", 7, and 8) (See Shape Distortion).

10. ERASURE. The use of the pencil eraser of the test materials to eradicate a mark previously made in the figure reproductions.

11. EXAGGERATION (Figure 6): The increase in area of the loops of either one or both of the wavy lines in Figure 6. The term refers only to this characteristic in this figure. This factor is related to the size of Figure 6, i.e., the length of the horizontal wavy line, but is not synonymous with Size Differences.

12. FIGURE ORDER: The order in which the figure reproductions have been placed in the test results sheet or sheets:
   1. METHODICAL; i.e., all figure reproductions follow each other in the direct or rigid sequence of "a", 1, 2, 3, 4, 5, 6, 7, and 8.
   2. ORDERLY; i.e., when 6 to 8 of the figure reproduction follow each other in direct sequence.
   3. LOOSE; i.e., when 3 to 5 of the figure reproductions follow each other in direct sequence.
   4. CONFUSED; i.e., when no more than 2 of the figure reproductions follow each other in direct sequence.

13. FRAGMENTATION (Figures "a", 4, 6, 7, and 8): The separation or division of the subparts of the figure in places usually not recognized by the gestalt principles; i.e., the breaking of usually solid lines into parts, the segmentation of a curve, the breaking up of a square into halves of a square in a way that is not Closure.
14. LEFT-RIGHT DISPLACEMENT (Figures 5, 6, 8): The shifting of the point of connection between subparts of a figure either to the left or to the right; the point of connection between the handle and cup of Figure 5, the point of connection or crossing of the vertical and horizontal wavy lines in Figure 6, the point of connection of the inside diamond to the top horizontal line of Figure 8.

15. LINEAR REGULARITY (Figures "a", 3, 4, 7, 8): The perceptual reproduction of the relationship between the lengths of similar lines of a figure or its subparts; i.e., the relation between the sides of the square in Figure "a", the ratio of the left vertical side to the right vertical side of the box in Figure 4, the ratio of the various similar sides in Figure 7, and the ratio of the various similar sides in Figure 8.

16. LIP APPROXIMATION (Figure 5): The bringing together of the lips of the cup of Figure 5 in such fashion as to tend to make, or actually make, a closed unit rather than the open cup. This is to be differentiated from Closure, although in the strict gestalt sense of the term, such behaviour is true "Closure."

17. MARGINS: The creation of an identifiable, consistent margin between the figure reproductions and the edge of the test results paper, this margin existing on either one, two, three, or all four sides of the paper. No identifiable margin is scored 1, a margin on one side of test page is scored 2, on two sides is scored 3, on three sides is scored 4, and on four sides is scored 5.

18. METICULOUS CAREFULNESS: The counting and checking of the count of the number of subparts of a figure on the standard cards; the attempt to use the pencil, fingers, or other devices in such fashion as to give a closer approximation of size or degree of angularity in a figure reproduction; the slow careful drawing of lines, small circles, and dots in figure reproductions.

19. NUMBER DISTORTION (Figures 1, 2, 3, 5, and 6): The perceptual reproduction of the number of subparts of a figure as existent in the standard card scores.

20. ORNAMENTATION: The addition or embellishment of the figure reproductions with one or a number of unusual symbols, drawings, caricatures, and the like which, even though present, do not destroy the original gestalt organization of the figure.
21. OVERLAPPING (Figure 7): The perceptual reproduction of the degree and placement of the overlapping in the subparts of Figure 7 as existent in the standard card scores. Though related to Separation of Parts, this factor is differentiated by its feature of overlapping.

22. PAGE COHESION: The total amount of the test results page that all of the figure reproductions cover.
1. Only one-third of one side of one sheet is used for all drawings.
2. Only two-thirds of one side of one sheet is used for all drawings.
3. More than two-thirds of one side of one sheet is used for all drawings.
4. One and one-half sides of one or two sheets are used for all drawings.
5. More than one and one-half sides of one or two sheets are used for all drawings.
6. More than two full sides of paper are used for all drawings.

23. PAIRING (Figure 1): The perceptual reproduction of the grouping of the dots in Figure 1 into parts by placing two dots close to each other and at a greater distance from their neighbours; whether the pairing starts with Dots 1 and 2 from the left side of the line of dots, or with Dots 2 and 3 from the left side of the dot line is not essential.

24. PARALLEL DISTORTION (Figures 4, 7, and 8): The compression of two parallel lines of a figure such that at one end of the lines they are closer to each other than they are at the other end; i.e., the standard card scores call for parallelism in the box sides of Figure 4, in the long lines of the subparts of Figure 7, in the long lines of Figure 8, and compression of these at either of their ends would be considered Parallel Distortion.

25. PERSEVERATION: The repetition of a just previously employed figure reproduction as the figure reproduction when a new stimulus card is presented. A definite distinction exists between this term and a high positive score for Number Distortion, though the behaviour in the two situations is similar in psychological usage.

26. POINTED LOOPS (Figure 6): The creation, in the figure reproductions, of a point in the apex of one or more of the loops of the subparts of Figure 6.
27. **REGRESSION:** The reversion from the use of MATURE concepts in figure reproductions (i.e., concepts characteristic of the figure reproductions of an individual with average intelligence, normal emotional adjustment, and of the same chronological age as the subject) to the use of less mature concepts in figure reproductions (i.e., concepts characteristic of the figure reproductions of an individual with average intelligence, normal emotional adjustment, but of much younger chronological age than the subject). Such reversions may include:
   a. the use of circles instead of dots.
   b. the use of slashes instead of circles, dots, or continuous lines.
   c. the replacing of loops, circles, and dots by scribbles that have no clear individual perceptual organization, but in their grouping do form the standard gestalt figure.
   d. the use of arcs instead of clear cut angles in the columns of Figure 3.

28. **REPEATED ATTEMPTS AT REPRODUCTION:** The starting of figure reproduction, either as part of a figure or as the whole figure, two or more times during the same testing period.

29. **REVERSAL (Figure 4):** The rotation on its axis of either subpart, but NOT the total figure, of Figure 4 such that the subpart is then in a fully reversed position from that existent in the standard card scores. This approximately 180-degree part-rotation is essentially possible only in Figure 4, a limitation separating Reversal from Rotation-Part.

30. **ROTATION-PART (Figures "a", 4, and 8):** The revolving, at the point of their connection, of the subparts of a figure in either clockwise or counterclockwise direction such that the angle subtended between them is greater or less than that existent in the standard card scores.

31. **ROTATION TOTAL (All Figures):** The revolving of the total figure on its axis in either clockwise or counterclockwise direction such that the angle subtended between the figure's horizontal axis and the horizontal edge of the test results paper is greater or less than that existent in the standard card scores.

32. **SEPARATION OF PARTS (Figures "a" and 4):** The splitting of the figure into subparts at the point where a
connection between the subparts is existent in the standard cards. This factor is related to closure, but is not to be considered synonymous with it; it is this distinction which excludes Figure 8 from being evaluated for this factor.

33. SHAPE DISTORTION (Figures "a", 3, 4, 5, 7, and 8): The stretching of a figure along its vertical axis relative to its horizontal axis, or the stretching of a figure along its horizontal axis relative to its vertical axis; the decreasing or increasing of the ratio of the length of a figure relative to its height.

34. SHEARING (Figure 5): The distortion, by shearing, of the cup of Figure 5 either to the left or to the right relative to its horizontal axis or base line; the tilting of the cup of Figure 5 to the left or to the right of the position as indicated in the standard card scores accompanied by a proportional distortion of the angles between the cup's sides and the cup's base line. This factor is not the same as Total Rotation.

35. SIZE DIFFERENCES (All Figures): The increase or decrease in linear or areal size of a figure from that existent in the standard card scores. In Figure 6 this is related to, but does not include, Exaggeration.

36. SKETCHING (Figures "a", 4, 6, 7, and 8): The use of repetitive strokes in forming the lines of a figure, i.e., three or more restrokings of one or more lines of a figure. This is to be differentiated from the draftsman or artist's technique, which can usually be ascertained in doubtful cases by simple questioning. This is to be differentiated, also, from scribbling and the regressive use of dashes or slashes.

37. TAILING DISTORTION (Figure 4): The perceptual reproduction of the proportionate amount of the curve in Figure 4 that extends to the right and to the left of the points where the curve touches its base line; the increase or decrease in the ratio of the total length of the curve to that linear extent of the curve between the points where it touches the base line.

38. VERBAL TEST RESISTANCE: The number of verbal statements made by the examinee at the beginning and during the test as complaints about the test and about the testing situation.
Definitions of Indices

a. A - Distortion of the circle as to whether the horizontal or the vertical axis is longer, with 1.0 being perfect.

Factor 2

C - Distortion of the angles of the square; less than 1.0 means stretched out vertically, 1.0 is neutral, or perfect, greater than 1.0 means stretched out horizontally.

Factor 1a

D - Distortion of the periphery of the square; 0.0 is normal.

Factor 15

E - Distortion of the axes of the square and circle as related to each other; 180 is normal.

Factor 30

H - Closure of the square and of the circle; 0 is normal closure; 1 means overlapping but closed; 2 is overlapping but NOT closed; 3 is non-closure. The score represents the total of the weighted scores.

Factor 3

M - The rotation of the total figure; a minus score means counter-clockwise rotation; a 0 score is normal; and a plus score is clockwise rotation. The size of the score gives the degree of rotation.

Factor 31

N - Size index, area in nature, of the circle.

Factor 35

C - Size index, area in nature, of the square.

Factor 35

P - Size index, area in nature, of the total figure.

Factor 35

1. A - Distortion in the number of dots used; 12 is standard.

Factor 19

B - Size in the average distance per dot; 2.15 is standard.

Factor 35

2. Ba - The average length of the columns of circles in Figure 2.

Factor 35

E - Average slope of the columns; 65 is standard.

Factor 1b

I - Average space per column relative to average height.
3. **B**-Distortion in the average distance between the dots of the centre line.  

**Factor 35**

**C**-Distortion between line lengths of the upper and lower line of dots; less than 1.0 means longer lower line; 1.0 is standard; greater than 1.0 means longer upper line.  

**Factor 15**

**D**-Distortion in the shape of the figure; 2.31 is standard; less than this figure means it is stretched vertically; greater than this means it is stretched horizontally.  

**Factor 33**

**H**-Distortion in the maintenance of distance relationship between the centre line dots; it is scored according to table with 9 being standard.  

**Factor 35**

**I**-Size indices, in nature of area, of the figure; 25.5 is standard.  

**Factor 35**

4. **D**-Distortion by compression or expansion of the vertical sides of the box relative to the horizontal side; 90 is standard; a lesser number means compression; a greater number means expansion.  

**Factor 1a**

**J**-Distortion of the angular relationship between the two parts of the figure; 145 is standard.  

**Factor 30**

**G**-Rotation of the figure; 0 is standard; a minus number means a counterclockwise rotation; a plus number means a clockwise rotation.  

**Factor 31**

**P**-Size index, area in nature, of the box.  

**Factor 35**

**Q**-size index, area in nature, of the curve.  

**Factor 35**

**R**-size index, area in nature, of the total figure.  

**Factor 35**

5. **A**-Distortion in the number of dots used in the cup.  

**Factor 19**

**B**-Distortion in the number of dots used in the handle.  

**Factor 19**

**C**-Distortion in the relative height to the width of the cup; 0.7 is standard; a smaller number means horizontal stretching; a larger number means vertical stretching.  

**Factor 33**
I-Rotation of the figure; 0 is standard; a smaller number means counterclockwise rotation; a larger figure means clockwise rotation.

J-Distortion of the horizontal point of connection of the handle to the cup; .29 is standard; a smaller number means the connection is closer to the cup's right edge; a larger number means the connection is closer to the cup's left edge.

K-Distortion in shearing of the cup's sides relative to its base line; 1.0 is standard; a smaller number means the cup leans to the right; a greater number means the cup leans to the left.

L-Size, in the nature of area, of the figure; 22.4 is standard.

6. Ea-The average area of the loops of the horizontal wavy line in Figure 6 obtained by multiplying the length and height of each loop separately and then calculating the average.

Fa-The average area of the loops of the vertical wavy line in Figure 6 obtained by multiplying the length and height of each loop separately and then calculating the average.

Ga-The regularity in the maintenance of the same area from loop to loop in the horizontal wavy line.

Ha-The regularity in the maintenance of the same area from loop to loop in the vertical wavy line.

J-Size, in length, of the horizontal figure.

7. A-Size, in the nature of area, of the figure X; 13.13 is standard.

B-Size, in the nature of area, of the figure Y; 7.48 is standard.

C-Size, in the nature of area, of the overlap area; 6.6 is standard.

D-Size, in the nature of area by squares, of the overlap area; 35 is standard.

K-Distortion in the relative size of X and Y: 1.12 is standard; a smaller number favours Y; a greater number favours X; 1.0 means both are of equal size.
M-Size, average of total figure, in area; 12.6 is standard.

Factor 35

U-Distortion in the relative angularity of the end angles of X; .44 is standard; a smaller number favours the obtuse angle; a greater number favours the acute angle.

Factor 1a

X-Distortion in X, the same as U; 4.6 is standard.

Factor 1a

Y-Distortion in Y, the same as U; 1.1 is standard.

Factor 24

Z-Closure within figures X and Y; scores are the same as for H in "a".

Factor 3

DD-Distortion of the length-width relation of X: 1.6 is standard; a smaller number favours width; a greater number favours length.

Factor 33a

EE-Distortion same as DD for Y; 1.6 is standard.

Factor 33a

C-Size of the figure in the nature of area; 44.24 is standard.

Factor 35

G-Distortion in the length-width relation of the large figure; 3.18 is standard; a smaller number favours the width; a greater number favours the length.

Factor 33a

I-Distortion in the relative point of connection of the diamond with the top line of the large figure; .46 is standard; a smaller number favours the left direction of contact; a greater number favours the right direction of contact.

Factor 14

J-Distortion in the relative size of the large figure's acute end angles; .82 is standard; a smaller number favours the angle on the right end.

Factor 1a

N-Closure within the larger figure and within the diamond: scores are the same as in H of figure "a".

Factor 3

9. FACTORS OF TOTAL TEST

A. ORDER in which drawings are placed on sheets.

Factor 12

1. Methodical-Rigid, i.e., all drawings follow each other in direct sequence of a, 1, 2, 3, 4, 5, 6, 7, 8.

2. Orderly, i.e., when 6 to 8 of the drawings follow each other in direct sequence.
3. Loose, i.e., when 3 to 5 of the drawings follow each other in direct sequence.
4. Confused, i.e., when no more than 2 of the drawings follow each other in direct sequence.

B. PAGE COHESION

1. Only one-third of one page is used for all drawings.
2. Only two-thirds of one page is used for all drawings.
3. Only three-thirds of one page is used for all drawings.
4. One and one-half pages are used for all drawings; can be either on front and back of same sheet, or on two sheets of paper.
5. Two pages are used for all drawings; can be same sheet, back and front, or two sheets of paper.
6. More than two pages are used for all drawings.

C. MARGIN

1. No identifiable consistent margin between edge of page and drawings maintained.
2. Identifiable margin maintained on one side of the page, for example, left side.
3. Identifiable margin maintained on two sides, i.e., top and left.
4. Identifiable margin maintained on three sides.
5. Identifiable margin maintained on four sides.

D. REGRESSION

1. Circles used instead of dots; score equals total number of drawings where this was done; possible score of 3.
2. Slashes, i.e., ////// used instead of circles, dots, or continuous lines; score equals total number of drawings where this was done; possible score of 9. Care should be taken so as not to mistake artistic sketching for this behaviour.
3. Curves, circles, loops, and dots replaced by scribbles, and have no clear perceptual organization; score equals total number of drawings where this was done; possible score 6.
4. Arcs used instead of clear-cut angles; score equals number of times this was done; possible score 1.
G. SKETCHING

Factor 36
1. Use of repetitive strokes in making a figure. (To be differentiated from the artist's technique which can usually be ascertained by simple questioning at the completion of the test.) Especially prominent for long strokes in Cards 7 and 8. Score is the number of figures where this was done; possible score 5.

H. ERASURES

Factor 10
1. Number of drawings where the erasure was used to make corrections; possible score 9.

I. REPEATED ATTEMPTS TO COPY THE FIGURES

Factor 28
1. Number of drawings where more than one attempt was made in copying a figure. Score is the number of drawings where this was done.

J. RESISTANCE TO THE TEST

Factor 38
1. Number of verbal statements made by the examinee at the beginning and during the test proper. Score is this simple counted number.

K. COUNTING AND CHECKING

Factor 18
1. Examinee uses his pencil, finger, verbally counts, or carries on other clearly evident motor behaviour in counting the number of dots, circles, or curves. Score is the number of drawings where this behaviour was carried on; possible score is 5.
APPENDIX B. PASCAL AND SUTTELL'S SCORABLE ITEMS.

DESIGN 1

1. Wavy line of dots. For this deviation to be scored, the dots should form a distinctly wavy line.
2. Dots, dashes, and circles. This deviation is scored when there is variability in the reproduction of the stimulus, i.e., when dots and dashes, dots and circles, dashes and circles, or all three, are used in the reproduction.
3. Dashes. For this deviation to be scored all the dots, or all except one dot, must be converted to dashes, i.e., lines of at least 1/16 inch, either horizontal or vertical.
4. Circles. For this deviation to be scored all the dots, or all except one dot, must be converted to clear, unfilled circles.
5. Number of dots. If, in the reproduction, the number of dots is less than 10, or more than 14 (and the dots are yet a part of the design, not "extra-scattered" dots) the item is scored.
6. Double row. This item is scored when the design is reproduced on two lines instead of one.
7. Workover. Some subjects so belabour the dots that they become large, and appear to result from the expenditure of a great deal of effort. Such elaborations are scored as "workover."
8. Second attempt. When the subject makes, and fails to erase, more than one attempt to reproduce the design, the item is scored.
9. Rotation. This item is scored if the design is reproduced vertically rather than horizontally, or if the reproduction is rotated from the horizontal 45 degrees or more.
10. Part of the design missing. If the design is reproduced with six or fewer dots, the item is scored.

DESIGN 2

1. Wavy line. For this deviation to be scored, the bottom row of circles should form a distinctly wavy line.
2. Dashes or dots instead of circles. Where dashes and/or dots are consistently (more than half) substituted for circles, the item is scored.
3. Circles showing tremor or other deviations in shape. Three or more of the circles should show tremor or deviate markedly from the circular, for the item to be scored.
4. Circles missing or extra in the column. Extra circles may appear in any of three ways: 1) as additions to the individual columns, 2) as overlapping circles in a
Single column, or 3) as a result of the design being reproduced by rows rather than by columns.

5. Circles touching. For the item to be scored, the circles must be so placed that they touch or overlap more than once.

6. Deviation in slant. There should be two or more abrupt changes in the slant of the columns and/or alignment to score here.

7. Number of columns. If, in the reproduction, the number of columns is less than nine, or more than 13, the item is scored.

8. Design on two lines. This deviation may occur in several ways: 1) the reproduction may be begun on one line and continued on another; 2) the columns may be divided into several series, each with its base on a different level; or 3) one column may be "dropped" decidedly below the level of the remaining columns.

9. Guide lines. Where lines are made to guide the placement of the circles, the item is scored.

10. Workover. When the circles are so belaboured that they become large thick masses, workover is scored.

11. Second attempt. Scored as item 8, design 1.

12. Rotation. Scored as item 9, design 1.

13. Part of the design missing. If the design is reproduced with six or fewer columns, or with two instead of three rows, the item is scored.

DESIGN 3

1. Asymmetry. Three types of asymmetry are scored: 1) spacing asymmetry, in which the space between dots varies markedly, 2) angle asymmetry, in which there is great disparity in the angles from the axis, and 3) dot asymmetry, in which there is an uneven number of dots on either side of the axis.

2. Dots, dashes, and circles. The item is scored as item 2, design 1.

3. Dashes. The item is scored when all the dots, or all except one dot, are converted to dashes.

4. Circles. The item is scored when all the dots, or all except one dot, are converted to clear, single-line circles.

5. Number of dots. The item is scored when there are more or less than 16 dots, dashes, or circles in the reproduction.

6. Extra row. The item is scored when there is an extra row of dots in the reproduction.

7. Blunting. The point of the arrow should be obliterated to score this item.

8. Distortion. To score, there should be destruction of the gestalt, resulting in a loose conglomerate of dots or in an extreme departure from the stimulus.
9. **Guide lines.** The item is scored as item 2, design 2.

10. **Workover.** The item is scored as item 7, design 1.

11. **Second Attempt.** The item is scored as item 8, design 1.

12. **Rotation.** Rotation is scored when the design is rotated 45, 90 or 180 degrees from its proper horizontal axis.

13. **Part of the design missing.** The item is scored when one of the rows is completely missing in the reproduction.

**DESIGN 4**

1. **Asymmetry of the curve.** For the item to be scored, the halves of the curve should be markedly asymmetrical.

2. **More than one break in the curve.** To score, more than one break in the curve must occur.

3. **Curve not centred on square.** For this item to be scored, the curve should be distinctly "off-centre", i.e., when the centre of the curve and the lower right corner of the square do not coincide.

4. **Curls added to extension(s) of the curve.** The end(s) of the curve must be extended in a distinctly circular motion for the item to be scored. The curl should turn back on itself, so that, if extended, it would cross the adjacent side of the curve.

5. **Curve and square overlapping or not joined.** Where the peak of the curve is separated by 1/4 inch or more, from the adjacent corner of the square, or where the curve overlaps the adjacent corner by 1/8 inch or more, the item is scored.

6. **Curve rotation.** The line bisecting the curve should form an angle of 135 degrees with the adjacent side of the square. When this angle is reduced to 90 degrees or less, the deviation is scored.

7. **Touch-up to the curve.** To score, an extra meaningless line must be attached after the curve has been completed.

8. **Tremor.** Tremor may be either of two types: fine, almost imperceptible, or gross, i.e., a generally unsteady line with large deviations from the intended direction of the line.

9. **Distortion.** The reproduction should be a marked distortion of the stimulus.

10. **Guide lines.** The item is scored, as item 9, design 2, where lines or dots are made to control the placement of the design.

11. **Second attempt.** The item is scored, as item 8, design 1, when the subject makes more than one attempt to reproduce the design, and fails to erase his first attempt(s).

12. **Design rotation.** When the base of the square is rotated 45 degrees or more from the horizontal, or when the curve is attached to the square more than one third of the distance along that particular side of the square,
from its proper point of attachment, i.e., the lower right corner of the square, the item is scored.

13. Part of the design missing. The item is scored when more than one third of either the square or the curve is missing.

DESIGN 5

1. Asymmetry of the curve. For this item to be scored, the two halves of the curve should differ markedly as in item 1, design 4.

2. Dots, dashes, and circles. The item is scored for the presence of combinations of dots, dashes, and circles, as defined in design 1, item 2.

3. Dashes. The item is scored for the conversion of dots to dashes, as defined in design 1, item 3.

4. Circles. The item is scored for the conversion of dots to clear circles, as defined in design 1, item 4.

5. Extension joined to curve at dot. The item is scored when the extension is joined to the curve at a dot, rather than between two dots as in the stimulus.

6. Rotation of the extension. Rotation of the extension is scored: 1) when the extension begins at or below the approximate mid-dot of the right side, 2) when the direction of the extension is reversed, to the left rather than to the right, and 3) when the extension begins to the left of centre.

7. Number of dots. The item is scored when there are fewer than 10, but more than five dots in the curve, and when there are fewer than four dots in the extension.

8. Distortion. The item is scored: 1) when there are five or fewer dots in the curve, 2) when the design is reproduced with lines rather than with dots, 3) when the design tends to a closed circle of dots, or 4) when there is marked distortion of the gestalt, resulting in either a loose conglomeration of dots or an extreme departure from the stimulus.

9. Guide lines. The item is scored as item 9, design 2.

10. Workover. The item is scored as item 7, design 1.

11. Second Attempt. The item is scored as item 11, design 4.

12. Rotation. The item is scored when the design is rotated 45 degrees or more from the horizontal.

13. Part of the design missing. The item is scored when the extension or at least half of the curve is missing.

DESIGN 6

1. Asymmetry. Asymmetry may be in terms of contour, or of differences between the two ends of either line: e.g., one end may be squared-off, curled, frayed, or worked-over.
2. **Angles in the curve.** For this item to be scored, there should be abrupt, distinctly angular change(s) in direction, i.e., a distinct angle should be substituted for a curve.

3. **Point of crossing.** For "point of crossing" to be scored: 1) the vertical line should cross the horizontal to the left of centre, or 2) the horizontal line should cross the vertical in the lower third.

4. **Curve extra.** When there are more than five sinusoidal curves in either the horizontal or the vertical line, the item is scored.

5. **Double line.** Each time a distinct double line appears in the reproduction.

6. **Touch-up.** Scoring is the same as that described for design 4, item 7.

7. **Tremor.** The item is scored as item 8, design 4.

8. **Distortion.** The item is scored when the essential gestalt is destroyed, e.g., when the sinusoidal curves of one line differ markedly from those of the other, or when the two lines do not intersect.

9. **Guide lines.** The item is scored as item 10, design 4.

10. **Workover.** Some subjects superimpose several lines on the single lines. When such elaboration results in a solid line of at least 1/16 inch, workover is scored. The workover may be either of the entire line(s) or of only a portion of the line(s).

11. **Second attempt.** The item is scored as item 11, design 4.

12. **Rotation.** The item is scored: 1) when the vertical line is rotated to the left, more than 10 degrees from the perpendicular, and 2) when the horizontal line is rotated 45 degrees or more.

13. **Part of the design missing.** One of the lines, or at least one-half of one of the lines, should be entirely missing for the item to be scored.

**DESIGN 7**

1. **Ends of lines not joined.** In reproducing design 7, the subject may fail to join the ends of the lines forming the hexagons.

2. **Angles extra.** The item is scored when there occurs in the reproduction more than six angles in either hexagon.

3. **Angles missing.** The item is scored when in either hexagon an angle is entirely missing, i.e., when there are five or less angles.

4. **Extra scattered dots and/or dashes.** To score, there must occur in the reproduction at least two dots and/or dashes which are not integrated into the design.
5. **Double line.** The item is scored as item 5, design 6.
6. **Tremor.** The item is scored as item 8, design 4.
7. **Distortion.** Distortion may occur in three ways: 1) when there is disproportion between the sizes of the two hexagons - for scorable deviation one must be approximately twice the size of the other, 2) when the two hexagons do not overlap or when they overlap excessively, and 3) when the design is otherwise reproduced in a markedly distorted manner.
8. **Guide lines.** The item is scored as item 9, design 4.
9. **Second attempt.** The item is scored as item 11, design 4.
10. **Rotation.** Rotation is scored: 1) when the lateral hexagon is rotated so that the 30 degree angle of the stimulus design is increased to 90 degrees or decreased to 0 degrees, and 2) when the entire reproduction is rotated.
11. **Part of the design missing.** The item is scored when the subject omits a major portion of one of the hexagons.

**DESIGN 8**

1. **Ends of the lines not joined.** The item is scored as item 1, design 7.
2. **Angles extra.** The item is scored when an extra angle occurs in either the hexagon or the diamond, as defined in item 2, design 7.
3. **Angles missing.** The item is scored when an angle is missing in either the hexagon or the diamond, as defined in item 3, design 7.
4. **Extra scattered dots and/or dashes.** The item is scored for dots and dashes not integrated into the design, as defined in item 4, design 7.
5. **Double line.** The item is scored as item 5, design 6.
6. **Tremor.** The item is scored as item 8, design 4.
7. **Distortion.** Distortion may occur in three ways: 1) when the design is extremely disproportionate in its length-width ratio, 2) when the diamond overlaps the hexagon by more than one-third of its area, when the diamond is so small as to cover only two-thirds of the distance between the sides of the hexagon, or when the diamond is placed in one of the extreme thirds of the hexagon, and 3) when the figure is reproduced in an otherwise markedly distorted manner.
8. **Guide lines.** The item is scored as item 10, design 4.
9. **Workover.** The item is scored as item 10, design 6.
10. **Second attempt.** The item is scored as item 11, design 4.
11. **Rotation.** The item is scored when the base of the design is rotated 45 degrees or more from the horizontal.
12. **Part of the design missing.** The item is scored when the subject omits the diamond, or at least one-third of either the diamond or the hexagon.
PASCAL AND SUTTELL'S SCORABLE ITEMS FOR CONFIGURATION SCORE

1. Placement of Design A. The item is scored when design A is placed in the lower two-thirds of the page. The reproduction of design A should be at least three inches from the top of the page for the deviation to be scorable.

2. Overlapping of the designs. The item is scored when the lines of one design overlap the lines of, or run into the "enclosed space" of, another design.

3. Compression. The item is scored when the reproductions are compressed to cover approximately one-half of the page, whether the half used is the top, middle, right, or left half.

4. Lines drawn to separate the designs. The item is scored when the subject draws lines to separate the reproduced designs. The deviation is scored even when only one such line is drawn.

5. Order. To score here, the arrangement of the drawings on the page must depart from logical order, but not markedly. Usually this type of ordering results from arbitrary placement of one or two reproductions.

6. No Order. When the ordering of the reproductions is confused, no order is scored. When there is ANY DISCERNABLE ORDER the item is NOT scored.

7. Relative size of the reproductions. The item is scored when there occurs pronounced variations in the size of the reproductions. The deviation is scorable even when only one of the designs is disproportionately compressed or expanded.
APPENDIX C. GEBETZ'S INDIVIDUAL AND GLOBAL SIGNS

Individual Signs

NUMERATION (number of wave crests in figure 6)
The number of waves in the production differs from the actual number in the stimulus figure. The correct number of elements is as follows: 4 wave crests in horizontal and 4 in vertical.

WAVE FLATTENING IN FIGURE 6
Marked decrease in amplitude of horizontal or vertical wavy lines. At least two of the waves should be so reproduced to be scored.

ASYMMETRY IN FIGURE 5
A symmetrical part of a figure is reproduced asymmetrically. Lines equal in length are made unequal, or regular contours are made irregular.

DISPLACEMENT IN FIGURES 5 AND 6
Shifting of the point of juncture of one part of a figure with another, either to the left or right or above or below. In the case of figure 5, junction of the tangential line at the centre of the semicircle is scored, as well as junction at the extreme right. Scoring of figure 6 is strict; the vertical line must cross the horizontal at the middle of the third horizontal wave; displacement is also scored if the horizontal line crosses the vertical in the trough at either end of the second (from the top) vertical wave.

CONTIGUITY IN FIGURE 6
Contiguous parts of the figure overlap or are only partially contiguous, or overlapping parts are made contiguous.

PARALLEL LINES IN FIGURE 8
Parallel lines are reproduced as converging or diverging.

UPWARD SLOPE IN FIGURES 1 AND 2
The reproduction inclines upward. Scoring is strict; any perceptible upward slant is scored, even if slight. Scored also for counterclockwise rotations up to 45 degrees.
SINISTRAD DIRECTION IN FIGURES 4 AND 5
Horizontally oriented stimulus figures are reproduced from right to left. In figure 4, either the open square or the bell or both, may be made from right to left. In figure 5, only the semicircle is scored.

COUNTING OF TEST FIGURE IN FIGURES 1, 2, 3, 5, 6
Subject overtly counts the number of dots, circles, columns, rows or waves in the stimulus figure, as indicated by moving pencil or finger over each element of the figure, counting aloud, moving lips, while counting subvocally, etc.

UPWARD DIRECTION IN FIGURE 6
The figure, part of the figure, or a line is drawn in the upward direction, i.e., from below to above.

COUNTING OF REPRODUCTION IN FIGURES 1, 2, 3, AND 6
The same as the category Counting of Test Figure, except that the elements of the reproduction, rather than the stimulus figure, are counted.

INITIAL PART (LEFT HEXAGON MADE FIRST) IN FIGURE 7
This refers to the part of the figure which is reproduced before the other part is made. Scored only if the left hexagon is made first.

ANGLE DIFFERENTIATION IN FIGURE 7
The two angles at the extremes of either hexagon are made essentially alike rather than as acute and obtuse.

PAIRING OF DOTS IN FIGURE 1
This refers to the centre dots, i.e., others than the first and last dots. Scored if not placed in five recognizable pairs.

CORRECTION IN FIGURE 4
An inaccuracy in the reproduction is rectified by drawing another line without erasing the incorrect one, by crossing out a part of the figure, or by partially retracing the incorrect part.

SAGGING LINE IN FIGURES A AND 4
Straight lines are reproduced as curved, sagging, convex or concave.

Global Signs

SPATIAL COMPRESSION
All of the figures are reproduced in the upper or lower half of the page.
ONE OR MORE REPRODUCTIONS OF ABBREVIATED LENGTH
Presence of one or more reproductions equalling or falling below the 10th percentile of the total control group in length.

TOTAL TIME LESS THAN 140 SECONDS
Scored when the total time is less than 140 seconds.
APPENDIX D. HU TT AND BRISKIN'S SUMMARY CRITERIA OF TEST FACTORS

Factor

1. Sequence
   a. overly methodical
   b. methodical
   c. irregular
   d. confused or symbolic

2. Position of the First Drawing

3. Use of Space I
   a. excessive
   b. constricted
   c. normal

Use of Space II
   a. excessive
   b. constricted

4. Collision
   a. collision tendency

5. Use of Margin

Scoring Criteria

No deviation from a fixed, rigid organization.
No more than two deviations.
More than two deviations, but the patient's plan is still determinable.
A sequence with no apparent logic.
A sequence with symbolic value to the patient.

Any placement of figure A other than the following is atypical: (1) in a rectangular area one inch from the left margin and top of the page extending to one inch from the right margin and then down two inches; (2) the upper left-hand corner of the page.

Space between 2 drawings is more than \( \frac{1}{2} \) of the corresponding axis of either figure.
Space between 2 drawings is less than \( \frac{1}{4} \) of the corresponding axis of either figure.

Less space than "a" but more than "b".

Factor 3a present in a record two or more times.
Factor 3b present in a record two or more times.

A figure actually running into one or more other figures.
Placement of a figure within \( \frac{1}{2} \) inch of another figure.

Placing 7 or more figures within \( \frac{1}{2} \) inch of the margin.
<table>
<thead>
<tr>
<th>Factor</th>
<th>Scoring Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>6. Shift in the Position of the paper</td>
<td>Rotation of the paper, on its initial presentation, at least or more than 90 degrees.</td>
</tr>
<tr>
<td>7. Shift in the Position of the Stimulus Cards</td>
<td>Turning the stimulus card 90 or more degrees from its position on initial presentation.</td>
</tr>
<tr>
<td>8. Over-all Increase or Decrease in Size of the Figures</td>
<td>An increase or decrease of the drawing in at least one axis by more than ( \frac{1}{4} ) of the corresponding axis of the stimulus qualifies as a change in size. Over-all increase or decrease is scored if changes occur in five or more drawings.</td>
</tr>
<tr>
<td>9. Progressive Increase or Decrease in Size</td>
<td>Increased or decreased size, by any amount, sequentially in six drawings.</td>
</tr>
<tr>
<td>10. Isolated Increase or Decrease in Size (Dilation or Cohesion)</td>
<td>An increase or decrease, in size of a figure or part of a figure, of at least ( \frac{1}{4} ) of the corresponding axis in the stimulus, by ( \frac{1}{4} ) more or less of the dimensions used in the rest of the figure, or by ( \frac{1}{4} ) more or less of the dimensions used in the preceding or subsequent drawing.</td>
</tr>
<tr>
<td>11. Closure Difficulty</td>
<td>Gaps, overworking, erasures, increased pressure at points where parts of the design join one another.</td>
</tr>
<tr>
<td>12. Crossing Difficulty</td>
<td>Redrawing, sketching, erasures, increase of pressure at the point of line crossings in any figure.</td>
</tr>
<tr>
<td>13. Curvature Difficulty</td>
<td>Any changes in the curves in a figure, such as increased amplitude, spiking, flattening, irregularity, changes in size.</td>
</tr>
<tr>
<td>14. Change in Angulation</td>
<td>Any change of more than 5 degrees in the reproduction of an angle.</td>
</tr>
<tr>
<td>a. increased</td>
<td>Increased acuity.</td>
</tr>
<tr>
<td>b. decreased</td>
<td>Decreased acuity.</td>
</tr>
<tr>
<td>Factor</td>
<td>Scoring Criteria</td>
</tr>
<tr>
<td>---------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>15. Rotation</td>
<td><strong>Rotation of the major axis of a figure.</strong> 5 to 15 degrees. 15 to 80 degrees. 80 to 180 degrees.</td>
</tr>
<tr>
<td>a. mild</td>
<td>Substitution of more primitive forms for more mature forms, provided that evidence of the patient's capability of producing mature forms is otherwise present.</td>
</tr>
<tr>
<td>b. moderate</td>
<td></td>
</tr>
<tr>
<td>c. severe</td>
<td></td>
</tr>
<tr>
<td>16. Retrogression</td>
<td>Replacement of parts of a Gestalt with a different and simplified form which is not more primitive from a maturational point of view.</td>
</tr>
<tr>
<td>17. Simplification</td>
<td>Reproduction of a figure by breaking it into parts or reproducing an incomplete figure.</td>
</tr>
<tr>
<td>18. Fragmentation</td>
<td>Difficulty with overlapping figures, manifest by failure to reproduce portions of the figure which overlap: simplification of either figure at the point of overlap, sketching or redrawing of the overlapping portions, distortion of the figure at the point of overlap.</td>
</tr>
<tr>
<td>19. Overlapping Difficulty</td>
<td>Adding to the original Gestalt by elaboration or doodling.</td>
</tr>
<tr>
<td></td>
<td>Substitution, inappropriately, of features of a preceding stimulus: replacing the circles of figure 2 with the dots of figure 1; replacing the dots of figure 3 and 5 with the circles of figure 2.</td>
</tr>
<tr>
<td>20. Elaboration or Doodling</td>
<td></td>
</tr>
<tr>
<td>21. Perseveration A</td>
<td>Continuing, inappropriately, the Gestalt beyond the limits called for by the stimulus. For figure 1, 14 or more dots must be present; for figure 2, 13 or more rows of circles.</td>
</tr>
<tr>
<td>22. Perseveration B</td>
<td>Atypical movement as follows: clockwise movement in a right-handed person, counter-clockwise movement in a left-handed person, vertical movement.</td>
</tr>
<tr>
<td>23. Movement Determinants</td>
<td></td>
</tr>
</tbody>
</table>
Factor  

24. Inconsistency in the Direction of Movement

25. Line Quality
   a. heavy lines
   b. heavy lines with incoordination
   c. faint lines
   d. poor coordination fine
   e. sketching

Scoring Criteria

lines drawn from the bottom up, movement from the outside to the inside of the Gestalt.

A sudden change from the characteristic direction of movement.

Dark in colour, drawn with heavy pressure which can be detected by running the finger over the back of the paper and feeling the resulting ridge; a tendency to taper off at the end of the pencil stroke.

The factors in 25a above, with irregularity and tremulousness. Lines are light, drawn with little pencil pressure. Irregularity of lines with an amplitude not exceeding 1/32 of an inch. Irregularity of lines, amplitude exceeding 1/16 of an inch. Repetitive attempts at completion of a line resulting in an inadequate reproduction.
APPENDIX E. BYRD'S FACTORS

1. PLACEMENT OF THE FIRST FIGURE was investigated in two areas on the paper. The upper middle area consisted of a rectangle, three and one-quarter by five and one-half inches, horizontally located in the centre of the paper one inch from the top. This area was slightly increased from that suggested by Hutt after preliminary scoring of the records revealed too few cases in any of the groups for a meaningful comparison. The second area was a two and one-quarter inch square in the extreme upper left hand corner. The size of this area was arbitrarily established to determine extreme placement which is reported to be a sign of timidity and fear and would be expected to be found more in emotionally disturbed children. Only figures whose entire dimensions were in either of these areas were scored.

2. SEQUENCE refers to the successive positions of the drawings as they appear on the record. The four types of sequence investigated were ORDERLY, IRREGULAR, OVERLY METHODICAL, and CHAOTIC. An orderly sequence was defined as one in which the child followed a regular succession in the placement of the figures with the exception that one inversion or change in direction was allowed. An irregular sequence was one in which more than one change in direction was permitted but it was still possible to determine by inspection that the change was logical, such as occurs in the need for greater space. An overly methodical sequence was defined as one with forced rigidity in which all figures followed an undeviating horizontal or vertical progression. A chaotic sequence consisted of a clear lack of any plan with the figures scattered about the page.

3. USE OF SPACE. Excessive variability in the size of children's reproductions made the comparison of amounts of space between drawings inadequate as an indicator of use of space. Only COMPRESSED USE OF SPACE was scored when all drawings were placed in an area of less than one complete half of the paper.

4. USE OF MARGIN refers to the use of the margin of the paper as a guide for placing the designs. Use of the margin was considered significant if six or more of the figures were within one-quarter-inch of any of the margins of the paper.

5. OVERALL CHANGE IN SIZE was scored if five or more figures showed an increase or decrease of either the vertical or horizontal axis by more than one-quarter of the axis of stimulus designs.
6. **CHANGE IN ANGULATION** refers to a change in the degree of the angle of a figure or the angle of intersection between parts of a figure from that of the stimulus design. Only changes greater than 15 degrees were considered. This factor was scored when there was either an increase or decrease in angulation in four or more of the eight figures with angles, or when angulation was not reproduced or maintained in both Figures 2 and 6.

7. **CHANGE IN CURVATURE** refers to the tendency to either accentuate or reduce curvature in curvilinear figures. It was determined by obtaining a ratio of perpendicular radii in Figure A and base-altitude ratios in Figures 4, 5 and 6. Deviations were scored as increase when the following ratios were exceeded; Figure A, elliptical with radial axis less than 8:10; Figure 4, 1:1; Figure 5, 1:1, Figure 6, 2:1 on the horizontal curve and 1.5:1 on the vertical. Significant decrease in curvature was scored when ratios were greater than: Figure 4, 3:1; Figure 5, 9:5; Figure 6, 5:1 on the horizontal curve or 6:1 on the vertical. A change in the majority of curves on either the horizontal or the vertical was necessary to score Figure 6. Change in curvature in two or more figures was considered significant.

8. **CLOSURE DIFFICULTY** refers to the difficulty in bringing the joining parts of a figure together and is manifest in a drawing by failure to connect, or by overlapping, lines at points of connection. The presence of closure difficulty in two or more figures was considered significant.

9. **OVERLAPPING DIFFICULTY** refers to failure to draw, or excessive distortion or erasure of, figures in which one line crosses another. This sign was scored if it occurred in either Figure 6 or 7.

10. **ROTATION** is the reproduction of a figure with a rotation of the major axis of the drawing without a change in the position of the stimulus card or paper. The rotation of any figure more than 15 degrees was considered significant.

11. **RETROGRESSION** is defined as the substitution of the stimulus by a more primitive Gestalt form. The presence of loops, lines, or dashes for dots anywhere in the record was considered significant.

12. **FRAGMENTATION** is the reproduction of only a part of the stimulus figure and was scored if present anywhere in the records.
13. ELABORATION is the adding of lines not present in the stimulus and was scored when present anywhere in the record.

14. COLLISION refers to the actual overlapping or running together of two or more adjacent figures and was scored if present anywhere in the record.

15. PERSEVERATION is the persistence of drawing behaviour which was appropriate for the previous figure but inappropriate for the present one. Perseveration was scored when dots replaced circles in Figure 2, loops replaced dots in Figure 3 or lines replaced dots in Figure 5.
### APPENDIX F. CEREBRAL DYSFUNCTION GROUP

<table>
<thead>
<tr>
<th>Age</th>
<th>Cerebral Palsy</th>
<th>Epilepsy</th>
<th>Other and Questionable Diagnoses</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 years</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>11 years</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>12 years</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>13 years</td>
<td>1</td>
<td>4</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>14 years</td>
<td>5</td>
<td>3</td>
<td>-</td>
<td>8</td>
</tr>
<tr>
<td><strong>Total</strong>:</td>
<td><strong>17</strong></td>
<td><strong>14</strong></td>
<td><strong>8</strong></td>
<td><strong>39</strong></td>
</tr>
</tbody>
</table>
Appendix F. Cerebral Dysfunction Group.

**Ten-year-olds**

<table>
<thead>
<tr>
<th>Sex</th>
<th>I.Q.</th>
<th>Scale B Score</th>
<th>Diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>M</td>
<td>90</td>
<td>120</td>
</tr>
<tr>
<td>2.</td>
<td>F</td>
<td>108</td>
<td>50</td>
</tr>
<tr>
<td>3.</td>
<td>M</td>
<td>98</td>
<td>54</td>
</tr>
<tr>
<td>4.</td>
<td>M</td>
<td>100</td>
<td>91</td>
</tr>
<tr>
<td>5.</td>
<td>M</td>
<td>96</td>
<td>54</td>
</tr>
<tr>
<td>6.</td>
<td>M</td>
<td>102</td>
<td>82</td>
</tr>
</tbody>
</table>

**Eleven-year-olds**

<table>
<thead>
<tr>
<th>Sex</th>
<th>I.Q.</th>
<th>Scale B Score</th>
<th>Diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.</td>
<td>M</td>
<td>97</td>
<td>42</td>
</tr>
</tbody>
</table>

---

1 Diagnoses quoted directly from records and in some instances from conferences with attending psychiatrist or neurologist.
### Eleven-year-olds (continued)

<table>
<thead>
<tr>
<th>Sex</th>
<th>I.Q.</th>
<th>Scale B Score</th>
<th>Diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.</td>
<td>F 104</td>
<td>10</td>
<td>Epilepsy, difficult behaviour...irritable periods...episodes of being &quot;fighting mad&quot;. Attending psychiatrist stated that although petit mal is in the record, the behaviour is hysterical.</td>
</tr>
<tr>
<td>9.</td>
<td>M 81</td>
<td>24</td>
<td>Epilepsy...mildly abnormal EEG...spike activity in region of vertex possibly associated with epilepsy...fits started at age 7...the boy suffers a profound emotional disturbance</td>
</tr>
<tr>
<td>10.</td>
<td>F 81</td>
<td>72</td>
<td>Spastic quadriplegia</td>
</tr>
<tr>
<td>11.</td>
<td>M 88</td>
<td>70</td>
<td>Cerebral palsy, choreo-athetoid...heavy scars covering skull</td>
</tr>
<tr>
<td>12.</td>
<td>M 77</td>
<td>86</td>
<td>Cerebral palsy, spastic diplegia</td>
</tr>
<tr>
<td>13.</td>
<td>M 89</td>
<td>82</td>
<td>Very hard labour...enormous head...fits at 18 months...temper tantrums...silly...excitable...blundering...destructive...EEG shows doubtful epileptic pattern</td>
</tr>
<tr>
<td>14.</td>
<td>F 76</td>
<td>38</td>
<td>Epilepsy...grand mal...twilight states...behaviour has deteriorated...crafty, aggressive,...automatic activity...amnesia...personality changes</td>
</tr>
<tr>
<td>15.</td>
<td>M 92</td>
<td>40</td>
<td>Severe spastic quadriplegia</td>
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</tbody>
</table>

### Twelve-year-olds

<table>
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<th>I.Q.</th>
<th>Scale B Score</th>
<th>Diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>16.</td>
<td>M 95</td>
<td>36</td>
<td>Lesion in left hemisphere around the sylvian point...behaviour has deteriorated. Neurologist claims, &quot;intra-cerebral lesion lying deep on frontal lobe&quot;.</td>
</tr>
<tr>
<td>Sex</td>
<td>I.Q.</td>
<td>Scale E Score</td>
<td>Diagnosis</td>
</tr>
<tr>
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<td>-----</td>
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<td>-----------</td>
</tr>
<tr>
<td>17. M</td>
<td>83</td>
<td>139</td>
<td>Epilepsy...EEG has shifting focus...left temporal from right posterior temporal...brain injury at birth...first fit at 3 months...talkative...restless...perseverative</td>
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<tr>
<td>18. M</td>
<td>96</td>
<td>44</td>
<td>Epilepsy...EEG abnormal...variable wave and spike with right frontal focus...deterioration since age 6 when seizures started...very aggressive</td>
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<tr>
<td>19. M</td>
<td>89</td>
<td>122</td>
<td>Spastic quadriplegia...marked balance reaction...difficulties in space perception</td>
</tr>
<tr>
<td>20. F</td>
<td>96</td>
<td>14</td>
<td>Epileptic for many years...head banging...impulsive...clumsy...restless...incessant talk...Psychological report states, &quot;classic picture of hysteria&quot;.</td>
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<tr>
<td>21. M</td>
<td>92</td>
<td>48</td>
<td>Mild spastic quadriplegia...little physical involvement</td>
</tr>
<tr>
<td>22. F</td>
<td>96</td>
<td>78</td>
<td>Spastic quadriplegic with little physical involvement</td>
</tr>
<tr>
<td>23. F</td>
<td>96</td>
<td>60</td>
<td>Spastic quadriplegia...perceptual difficulties and abstract thinking limited</td>
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<tr>
<td>24. F</td>
<td>113</td>
<td>38</td>
<td>Right sided hypoglossal palsy and nystagmus...slurred speech...posterior craniotomy...tumour partially removed and deep X-ray...abnormal EEG...parents separated...child severely disturbed...psychotherapy</td>
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</table>
### Thirteen-year-olds

<table>
<thead>
<tr>
<th>Sex</th>
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<th>Diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>25. M</td>
<td>118</td>
<td>30</td>
<td>Epilepsy...two severe head injuries as a child...EEG-definite lesion in left temporal lobe...major seizures...violent rages...dangerous to self and to others...strange, moody, wanders about all night...Considered the terror of the institution</td>
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<tr>
<td>26. M</td>
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<td>30</td>
<td>Fractured skull at 15 months...headaches until recently...suspected brain damage...early emotional deprivation</td>
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<tr>
<td>27. M</td>
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<td>50</td>
<td>Epilepsy...generalized abnormality of a moderate degree...fits followed severe measles...behaviour has deteriorated...aggressive...destructive</td>
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<tr>
<td>29. M</td>
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<td>Poliomyelitis...seizures</td>
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<tr>
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<td>72</td>
<td>Mild spastic quadriplegia...poor balance reactions...school considers him emotionally disturbed</td>
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<tr>
<td>30. M</td>
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<td>Epilepsy...EEGs deteriorating...recent EEG-clear focus in right mid-temporal region...first fit at 25 months</td>
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<tr>
<td>31. M</td>
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<td>10</td>
<td>Epilepsy...car accident...skull fractured at 11 years...EEG abnormal...maximum in parieto-temporal areas...no single focus...initial deterioration followed by marked improvement</td>
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### Fourteen-year-olds

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<th>Diagnosis</th>
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<td>Right hemiplegia...deaf in left ear...emotionally disturbed</td>
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### Fourteen-year-olds (continued)

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APPENDIX G.

1. Face Sheet
2. TMT-A
3. TMT-B
4. TMT-Supplement
1. ARCHIMEDES

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<td>Spiral B</td>
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    Larger    Smaller    No Change

11. Bender Gestalt.

<p>| | |</p>
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| A |  
|---|---
| 1 |
| 2 |

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Total time

111. Trail Making.

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<table>
<thead>
<tr>
<th>Part B</th>
<th>Errors</th>
<th>Time</th>
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Total
Trail Making Part A

1 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
Trail Making  Part B

6  D  8
3  1
10  1

J  4  G  L

13  A  11  C

F  2

1  12  E  H

5  10  7  6
1 to 8
A to G

Trail Making Test
Supplemental Form
### APPENDIX H. CUTTING SCORES

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<th>No. of Normals Above</th>
<th>% Normals Above</th>
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<th>% E.D. Below</th>
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<th>Total Loss (%)</th>
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<td>No. of Normals Above</td>
<td>% Normals Above</td>
<td>Cerebral Dysfunction Below (No.)</td>
<td>Cerebral Dysfunction Below (%)</td>
<td>Total Loss (No.)</td>
<td>Total Loss (%)</td>
</tr>
<tr>
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### APPENDIX H

**Pascal-Suttell: Age Group Cutting Scores**

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<th>Cutting Score</th>
<th>Normals Above No.</th>
<th>Normals Above %</th>
<th>Normals E.D. Above No.</th>
<th>E.D. Below No.</th>
<th>E.D. Below %</th>
<th>Total Loss No.</th>
<th>Total Loss %</th>
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<tbody>
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### Screening Scale A
#### Emotionally Disturbed

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<th>No. of E.D. Below</th>
<th>% E.D. Below</th>
<th>Total Loss No.</th>
<th>(Average) Total Loss %</th>
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<td>Cerebral Dysfunction Below (%)</td>
<td>Total Loss (No.)</td>
<td>Total Loss (%)</td>
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