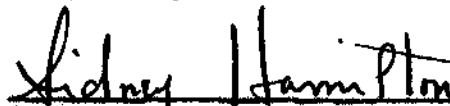


PSYCHOMETRIC PATTERNS OF THE WECHSLER-BELLEVUE
INTELLIGENCE SCALE SUBTESTS AS AN INDICATOR
OF SCHIZOPHRENIC SYNDROMES

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OF SCHIZOPHRENIC SYNDROMES**

THESIS

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CHAPTER I

INTRODUCTION

General Statement

At no period in the history of psychology and education has the study of human personality represented such a universal interest as it does today. Such studies are prominent in contemporary literature. This is illustrated by the fact that in everyday life the one thing that commands general attention is a knowledge of the individuals comprising the group with which one is acquainted.

Clinical psychiatry has two basic and time-honored methods utilized in the study of personality: that of the case history, and that of clinical observation. Both of these methods are powerful tools in the hands of the experienced psychiatrist; nevertheless, each has its shortcomings. Historical information, whether obtained from the patient or from other informants, will have omissions and distortions. Thus, in gathering the material on which the diagnosis is to be based, the historical case material is affected by subjective factors on the part of both informant and psychiatrist. Such reports can and do more than pick out a few highlights of the patient's behavior which, as a time sample, may be inadequate, and even though correct

qualitatively and useful practically, are nevertheless subjectively selected by the psychiatrist.

Psychological testing is an effort to obtain whole and systematic samples of certain types of verbal, perceptual, and motor behavior, in the frame of a standardized situation. The advantage of data collected in psychological tests is that little, and in many tests, no subjective selection is involved in securing the data.

In the psychiatrist's organization of the case material, his experience and knowledge, colored by subjective factors, play a considerable role. In psychological tests, more or less standard scoring systems provide for an organization of the data which is relatively free from such subjective factors. It is true that in applying the scoring there is more likelihood for subjective factors to enter the test material than there is in securing the raw test data.

Clinical psychological testing procedures may be especially valuable to clinical psychiatry in certain special circumstances. Where case history is missing, insufficient, or for other reasons unsatisfactory, the possibility of obtaining the necessary information by means of tests gains in importance. In situations where time is short, or where other limitations make the taking of the case history inadvisable, the information obtainable through tests may be

invaluable. Where scarcity of psychiatric services makes it necessary that the psychiatrist devote himself to therapeutic work, leaving relatively little time for intensive diagnostic study, testing procedures become an important adjunct in shortening laborious case-history-taking and observation.

The manual for the Wechsler-Bellevue Intelligence Test stresses the potential clinical utility of this instrument for differentiating a variety of psychiatric disorders. This differentiation is based not on the traditional intelligence quotient, but rather on the individual patterns composed of the variation of sub-test scores about their own mean.

The present study was designed to determine whether there were any specific psychometric patterns presented, as characteristic of the four types of schizophrenia.

Since various patterns have been offered for possible diagnostic purposes, such an evaluation was deemed to have both practical and theoretical significance.

Specific Objectives

The specific objectives of this investigation are as follows:

1. To determine which half -- verbal half or performance half -- of the Wechsler-Bellevue Intelligence Test contributes most to total intelligence quotient for schizophrenics.

2. To determine whether any significant correlation exists between test scores and patterns of schizophrenics and normals.

3. To determine whether there exists any premature aging process in schizophrenics.

Significance of the Problem

J. R. Wittenborn, in commenting on the use of Wechsler-Bellevue subtest scores as an aid in psychiatric diagnosis, says:

Marked variability in subtest scores has long been considered as an evidence for mental pathology. Subtest scores' variability has been particularly conspicuous among schizophrenic patients. Schizophrenic patients are in most cases highly variable in their general behavior and marked intertest variability would be expected for such cases.¹

Is there a relationship between the pattern of an individual's personality and his pattern of ability? Could such a relationship be demonstrated, it would contribute most substantially to our understanding of human ability and human personality.

Scope of the Study

The subjects in this study were sixty-two patients of the Terrell State Hospital, Terrell, Texas, diagnosed as schizophrenic by the psychiatrists in attendance at the

¹J. R. Wittenborn, "An Evaluation of the Use of Bellevue-Wechsler Subtest Scores as an Aid in Psychiatric Diagnosis," Journal of Consulting Psychology, XIII (1948), 433.

regular case conferences or staff meetings. Within the group of sixty-two schizophrenics were: five catatonic, thirty-eight paranoids, four simple, and fifteen hebephrenics. The age range of the patients was from sixteen to fifty-nine years with a mean of 38.40 years.

The subjects were all English-speaking. Their previous education ranged from third grade to college graduation, the mean educational level being the third year of high school. Full Scale intelligence quotients on the Wechsler-Bellevue ranged from 56 to 123, with a mean of 93.08, and a standard deviation of 39.8.

In regard to shock therapy, twenty-nine subjects had received none at the time of the test, twenty-seven were being given or had completed a series of electric shocks, three had finished an insulin course and one was still under such treatment, one had received both insulin and electric shock, and one both electric shock and metrazol. In those cases still receiving the various shock treatments, a period of at least twenty-four hours was permitted to elapse from the time of the last treatment to the administration of the test.

Procedure

Directions given by Wechsler² were followed throughout.

²David Wechsler, The Measurement of Adult Intelligence, pp. 172-186.

Tests were conducted individually by the writer and by another well-qualified clinician. The administration of the test generally consumed about seventy-five minutes and the scoring of each test was done subsequent to the examination period. All tests were completed in one session.

The majority of patients were acquainted with the examiner who, in the course of a practicum at the hospital, as well as in the line of his duties as assistant psychologist, had administered them other psychological tests at previous times. Rapport, therefore, was already established and a friendly attitude prevailed. Co-operation was at least fairly good, and many patients put forth real effort and expressed an interest in the test. The resulting performance is considered representative of the patient's ability at the time of the test, and differences noted from the normals should be indicative of psychotic pattern.

The control groups used for comparison with the test results of the psychotic patients are Wechsler's standardization population. Wechsler supplies the means and standard deviations on all tests of the scale for 345 subjects, aged seventeen to twenty-nine years, and for 345 subjects, aged forty to forty-nine years. In addition to comparison with these normal controls, the results are compared with data obtained by Wechsler, Rabin, Margaret, Weider, and Rapaport on schizophrenic subjects.

Definition of Terms

Schizophrenia. -- A psychosis which appears as a garbled reaction on the part of an individual who lacks the deep instinctual capacities and feelings in meeting the acute problems of reality. There is either a total lack of normal affect or a perversion of the emotions and with this a tendency to withdraw into a world of one's own subjective construction. The disease may develop at any age, but the greatest number of its victims are found in the adolescent and earliest adult periods of life between the seventeenth and the twenty-fifth years.

Kraepelin, the German psychiatrist, recognized four types of schizophrenia. This classification implies not so much a different mental picture in each type, but rather points out the different methods whereby the individual attempts to compensate for his feelings of instinctual inadequacy and his desire to maintain some degree of inner comfort and freedom from painful self-consciousness and unconscious conflict.³

I. Simple type. -- In this condition the patient manifests his defects by being simply a colorless and disinterested person. He lives in idle fantasy, content to lead a simple, shiftless life without ambition. Interests are

³Louis J. Karnosh and Edward M. Zucker, A Handbook of Psychiatry, p. 103.

small; there seems to be no great concern over important events and no desire to assume any responsibility. Conversation is scant and trivial, and the individual prefers his own company and rarely shows any interest in the opposite sex. Normal heterosexual development and social instincts seem to be lacking. Occasionally there may be periods of unrest and irritability, but these are short-lived, and the patient sinks more and more into a dull, apathetic state. In spite of this torpor, the intellect may be fairly good, and the patient rarely gives evidence of delusions or hallucinations. Nonetheless, the total effect is that of a queer person who is inaccessible, hard to get acquainted with, and decidedly uninteresting.⁴

2. Hebephrenic type. -- This form of schizophrenia occurs at an early age and represents a more severe disintegration of personality than do the other types. Patients who develop hebephrenia are young people who have been unmistakably queer and overscrupulous about trivial things, and who have been particularly given to brooding over religious and obscure philosophies while their normal schoolmates indulged in natural play and social activity. Ideas of reference are commonly expressed; normal contact with others seems distasteful; and the patients give themselves over to phantasies and to long periods of seclusiveness.

⁴Ibid., p. 105.

A silly smile or shallow laughter on little or no provocation is frequently noted as the earliest sign of true mental breakdown. Hallucinations of sight and hearing are invariably demonstrated. Peculiar mannerisms appear, which are repeated over and over again; speech becomes incoherent; and the patient becomes progressively indifferent to relatives and to the normal activities of the household. Outbursts of anger, obscene behavior, and a frank absence of any modesty or sense of shame indicate that the patient no longer cares to maintain self-esteem and is content to revert to silly, childish levels of behavior and responsibility. This process of retreating into infantile levels of reaction and into life entirely dominated by phantasy is called regression.⁵

3. Catatonic type. -- This mental disturbance develops much more suddenly than do other forms of schizophrenia, and frequently in individuals who are not particularly lacking in emotional development. It is characterized by an acute stupor associated with a sudden loss of all animation and a tendency to remain motionless in a stereotyped position or posture. The facial expression becomes vacant, and the skin waxy in appearance; the patient becomes mute and apparently is unable to comply with the simplest order or request. The lips are often pursed in a

⁵Ibid., p. 108.

peculiar way; the saliva drools from the mouth; and the hands and feet may become blue and swollen because of the immobility. Such patients must be dressed, washed, and moved about by force from room to room; they apparently are insensitive to any threats or to painful stimuli.

Without warning, this passive or stupor state may give way to sudden, violent, hateful outbursts during which the patient suddenly becomes voluble, argumentative, and even homicidal. Such violent episodes are known as catatonic excitement.

This alternation between periods of stupor and excitement gives this form of schizophrenia a distinctive quality which, in some respects, may liken it to a manic-depressive psychosis. Differential diagnosis is not always easy, and it is possible that catatonia is a psychosis which in some respects is a half-way state between schizophrenia and the affective-reaction psychoses.⁶

4. Paranoid type. -- This form of schizophrenia tends to develop at a later period of life, generally in the later twenties or the early thirties. Delusions of an absurd, illogical quality dominate the clinical picture. Behind these one always finds the usual inadequate social development and emotional lameness. Apparently the patient with paranoid schizophrenia attempts to maintain self-esteem

⁶Ibid., p. 110.

and cover up his sense of inadequacy by explaining it away in terms of false beliefs of persecution or of grandeur; even depressive and hypochondrical delusions are common. Not only are the delusions silly and unbelievable, but they are numerous and changeable to meet the special psychologic needs as they may occur. Critical judgment is necessarily poor, and reality must be warped to fit in with the patient's own phantastic projections. Behavior is erratic, unpredictable, and even dangerous because of the paranoid condition.⁷

The Psychological Rationale of the
Wechsler-Bellevue Subtests

Vocabulary. -- Clinical experience teaches that vocabulary, once achieved, will be quite refractory to impairment by temporary or sustained inefficiency and deterioration, though it may change its form of functioning to levels of definition, that is, conceptualization, which are much less adequate than those used by the patient at the time when his vocabulary reached its greatest scope and efficiency. Although vocabulary test studies tend to exaggerate the stability of the vocabulary function, they nevertheless do bring to expression its highly stable nature.

In evaluating vocabulary achievement one must keep in mind, first, that the basic point in the "psychology of

⁷Ibid., p. 115.

vocabulary" is the relatively refractory nature of vocabulary to deterioration; second, that given an undisturbed "function" and an unhampered process of maturation, vocabulary depends for its development more upon original wealth of educational environment than upon late schooling and variety of life experience; third, that when "function" is disturbed in the beginning, the lack of vocabulary attainment will reflect it; and fourth, that not only the disturbed or undisturbed condition of the "function," but the specific quality of the disturbance of the "function" -- namely, its readiness either to accumulate or to avoid accumulating information and knowledge -- plays also a crucial role in the development of vocabulary.⁸

Comprehension. -- It appears that the concept "judgment" is one of those many concepts which are used without their having attained a sufficient conceptual clarification. "Judgment" evidently refers to a function on the borderline of intellectual and emotional functions. It appears to refer to the emotionally relevant use of one's assets in regard to the reality situation, where, though intellectual and logical correctness is implied, they play a rather subordinate role. The terms "proper" and "appropriate" are other terms commonly used to indicate actions brought about by good judgment.

⁸David Rapaport, Diagnostic Psychological Testing, I, 87.

The "comprehension" items, like situations requiring judgment, demand more than possession and activation of information; they demand meaningful and emotionally relevant activation, selection, and organization of those facts and relationships known to the subject. They demand also a delaying of first impulses.

The information possessed and the relationships known must be so structured as to meet the questions' requirements. This is thus a complex function, which can be expected to be neither so refractory to impairment as vocabulary nor so high in development as vocabulary in the "intellectualizing" clinical groups. As a matter of fact, the defense of "intellectualization" may be considered to have been developed to replace judgment because of the presence of doubt.

The vulnerability of the "comprehension" subtests to impairment appears to be readily understood from another point of view. While in an "information" problem the answer is known or not known, in a "comprehension" question the information and knowledge activated -- brought into consciousness -- by the question are multiple, if not infinite. Thus, it is not merely the grasp of information and knowledge, but also proper selection and emphasis of it which can become impaired. Information can be learned and retained; but balance of the varied factors that go into good comprehension and judgment can be acquired progressively

only by prototype and experience, and cannot be taught. The relationships of information, knowledge, and comprehension here discussed have played a considerable role in giving many an educator a feeling of the futility of all education.⁹

Information. -- In analyzing and interpreting the "information" subtest, the examiner should keep in mind these considerations more than in any other of the subtests. To "pick up," out of the educational and cultural environment, information of factual data is a much simpler and more direct process than to "pick up" knowledge of relationships. Here endowment, wealth of the educational environment, degree of schooling and of cultural predilection, come more clearly to an expression than in any other subtest except that of vocabulary. At the same time, impairment and arrest must set in early to have a prohibiting effect upon the accumulation of information. Furthermore, deterioration, or disorganization of function by acute disturbances, must be considerable before it will encroach significantly upon availability -- in the test situation -- of information, once accumulated. It is true that information, like all memory material, can become momentarily unavailable as a result of "temporary inefficiency" -- that is, in a situation full of anxiety where the proper attitude, which mobilized

⁹Ibid., p. 110.

the memory of information, may be disturbed. Such impairments are usually spotlike, however, and do not cover a large part of the field of information as reflected in the responses to the twenty-five questions of the "information" subtest. Similar spotlike impairments may be also expressions of generalized "repressive" trends.

Thus, the nature of the "information" subtest allows the hope that a careful analysis of it will give a clue as to the endowment, early arrest of maturation, early setbacks, wealth of the educational environment, degree of schooling and cultural predilections, and finally, the severity of the present maladjustment -- that is, whether its effects are merely temporary inefficiencies, or essential inefficiency of function which prohibits the making available in the testing situation of information possessed.¹⁰

Similarities. -- Concept formation is the function which informs the human being about the "belonging together" of the objects and events of his everyday world. Each word with which one names an object implies an automatic concept formation; a placing of the object implies where it "belongs" in one's world. Every percept -- in so far as it is "apprehended," and not considered merely a psychological process -- implies concept formation, because to identify anything implies determining where it "belongs." Consequently, every

¹⁰Ibid., p. 129.

thought process, the most simple and the most complicated, implies concept formation -- in the sense that our looking upon, and mode of discerning, thought processes is such that concept formation always appears to be one aspect of them. Concept formation as a conscious, voluntary, effortful process is experienced in all systematic scientific endeavor; but even here it may occur in an automatic, effortless manner in the form of "hunches," "experiences," and so on. In everyday thought processes, where not too much of the unknown or the emotionally difficult is encountered, concept formation is mainly automatic and effortless. Affective orientations and attitudes build the world of the individual -- that is, structure it in patterns of conceptual coherence, into which he organizes new experiences automatically when the patterns are not disrupted by the encroachment of maladjustment. Symbolism and physiognomic characters are the most primitive conceptual coherence patterns, and here the affective nature of conceptual organization is clearly perceptible. Symbols, physiognomic impressions, and all these patterns of "belonging" and "meaning" which are characteristic of the "unconscious" are organized around affects. The development of conscious thinking, however, tends to replace these idiosyncratic, affective conceptual organizations by verbal, abstract, and communicable ones, common to the social group and tuned to reality. Yet this process of

replacement never exercises the idiosyncratic, affective origin of conceptualization. The assumption that concepts are commonly accepted is shattered when one puts questions like those of the "similarities" subtest to many "normal" subjects.¹¹

Digit span. -- There is perhaps no test that has been so universally used in scales of intelligence as that of memory span for digits. It forms part of the original Binet scale and all the revisions of it. It has been used for a long time by psychiatrists as a test of retentiveness and by psychologists for all sorts of psychological studies. Its popularity is based primarily on the fact that it is easy to administer, easy to score, and specific as to the type of ability it measures. Nevertheless, as a test of general intelligence, it is among the poorest. Memory span, whether for digits forward or backward, generally correlates very poorly with all other tests of intelligence. The ability involved contains little of "g," and as Spearman has shown, is more or less independent of the general factor. Wechsler states:

For a long time we considered the desirability of eliminating the test from our battery altogether, but finally decided to retain it for the following reasons:

While memory span for digits forward and backward is on the whole a poor measure of intelligence,

¹¹Ibid., p. 147.

it is nevertheless an extremely good one at the lower levels. Except in cases of special defects or organic diseases, adults who cannot retain five digits forward and three backward will be found, in nine cases out of ten, to be feebleminded. Special difficulty with the repetition of digits forward or backward is often of diagnostic value. Obvious examples are the memory defects which constitute clinical symptoms in certain organic and other types of cases. A marked falling off in memory, or in memory span, is often one of the earliest indications of them.¹²

Wells has pointed out that the relationship between the number of digits that an individual can repeat forward and those he can repeat backward is often of diagnostic value in certain organic cases.¹³

Low scores on the digit-span test are frequently associated with attention defects. Individuals with these defects seem to have a special difficulty repeating digits backward. This deficiency is often referred to by psychologists as lack of mental control. The term is unfortunate as it implies, and is often interpreted as meaning, not only an inability to hold things before the mind, but also as a lack of self-control, in the broader sense. Nevertheless, the failure to repeat digits backward does often correlate with difficulties of attention and lack of ability in doing intellectual work which requires concentrated effort. Knowledge of this fact is frequently an aid to clinical diagnosis.¹⁴

¹²Wechsler, op. cit., p. 83.

¹³F. L. Wells, Mental Tests in Clinical Practice, p. 75.

¹⁴Wechsler, op. cit., p. 87.

Arithmetic. -- The usual psychometric assumption is that arithmetic is a good test of "g"; and, in fact, it correlates highly according to Wechsler's tables with most of the subtests, except for "picture arrangement" and "object assembly." Arithmetic is considered here a test of concentration, because to pass the items of this subtest which, excepting perhaps the last two, consist of the four basic calculations, the subject -- the average person of our civilization -- must utilize patterns of arithmetical relations ingrained in him. He must reflect on and deliver the answers from the pattern he possesses. Such focusing upon internally or externally, actually or potentially existing patterns to discover and amend them, is concentration.

The psychology of "arithmetic" is not a sufficiently explored territory. Nevertheless, it is clear that it is one of the purest forms of abstract thinking, which follows most closely and is really the prototype of the rules of the secondary process, and which, once obtained, does not have reference to any kind of past experience in its application. Thus its application is referable more to concentration proper than to any other aspect of psychological functioning. Every process of ordered thinking presupposes concentration, voluntary effort, employment of energies "non-specifically-deployed" and at the disposal of the Ego.

But in much of ordered thinking the material upon which concentration is required is not available to the subject's consciousness, as are either the "picture completion" drawing through perception or the arithmetical basic relations through introspection; the material of most ordered thinking must be first delivered "automatically" by memory, "anticipation," and so on.¹⁵

Thus concentration comes into play as a secondary function only, even though this role may be crucial in organizing complex materials; while in the simple processes of ordered thinking implied in these arithmetic problems, concentration is the primary function at play.

Picture arrangement. -- Planning and anticipation are important considerations here. Planning ability is a concept very rarely used in psychological terminology. Even in common-sense usage it is a rather infrequent term. Only in assessing executive abilities is this or equivalent terms used with relative frequency. It is rather surprising that the term and its psychological implications have been so little explored, especially since the function referred to appears to be one of our most human qualities.¹⁶

The question of the role of planning ability and anticipation in "picture arrangement" is discussed by Rapaport in the following manner:

¹⁵Rapaport, op. cit., I, 195.

¹⁶Ibid., p. 217.

The relationship of the Picture Arrangement subtest to planning ability is in need of clarification. No doubt there is a great difference between arranging a series of pictures into a story-sequence and planning one's own life-endeavors, the layout of a business organization, or only a day's over-filled schedule or one's moves in a chess game. But if we will recall what is requisite to a simple conversation -- which might well serve as the simplest pattern of planning -- we are much reminded of organizing a series of isolated pictures into a sequence. For a conversation between two persons not to become stagnant, the prerequisite is that each person get the implication of the other's statements and anticipate the direction his ideas are taking. This is true not only for conversation, but even for the simple reading of a sentence. We read not by reading every word singly and putting them together; rather, when a sentence starts with a "thought," it awakens in us an anticipation of a sentence structure or pattern of antithesis, into which we shall integrate -- or which shall define our integrating, organizing, and giving meaning to -- the verbal content of the rest of the sentence. If we do not anticipate, we do not understand what we read.¹⁷

Picture completion. -- It could be argued that this is merely another type of information test, depending upon the patient's intimate and accurate knowledge of the pictured objects. For the average individual of our civilization most of these items do not require any special kind of information, but rather common information from everyday life. Experience indicates that expression of a lack of information by the subject is a guise for faltering concentration, and usually a source of failure. A survey of the pertinent experiences will elucidate this point. Reference to lack of knowledge is made by patients almost exclusively

¹⁷Ibid., p. 222.

on No. 4 (the playing card), No. 5 (the crab), No. 7 (the ship), and No. 13 (the light bulb). On the crab some patients say, "I wouldn't know -- I never saw a crab"; but the fact is that living creatures are as a rule symmetrical, and a concentration on the picture readily reveals the asymmetry caused by the missing leg of the crab; and inquiry about playing cards usually reveals that the subject knows that the dots and numbers on them are supposed to correspond to each other. In other words, checking of parts of the picture with knowledge extant would have brought about the solution. The reference to lack of knowledge here is merely a guise for impaired concentration.¹⁸ Further, Rapaport states:

It is likely that many psychologists will consider the deficient function here to be one of reasoning. It is difficult to argue against this point of view, because what is here called concentration is the kernel of all reasoning. We prefer to consider reference to inconsistencies in common patterns as concentration; and to reserve the concept of reasoning for the more complex processes which are characterized by the interaction of attention, concentration, possibly anticipation, concept formation, and so on.¹⁹

Object assembly. -- The best features of the "object assembly" subtest are its qualitative merits. Various examiners have praised the test repeatedly, because it reveals

¹⁸Ruth Strang, "Methods, Techniques, and Instruments of Mental Hygiene Diagnosis and Therapy," Review of Educational Research, XVI (1946), 438.

¹⁹Rapaport, op. cit., p. 231.

something about the thinking and working habits of the subjects. The subjects' approach to the task may, in fact, be one of several kinds. The first is that of an immediate reaction to the whole, accompanied by critical understanding of the relation of the individual parts. This is particularly true of responses to the manikin test, in which one can distinguish between the individual who recognizes from the start that he has a human figure to put together, from another, usually a mental defective, who has no idea what he is assembling but merely fits the pieces together by the trial-and-error method. A second type of response is that of rapid recognition of the whole but with imperfect understanding of the relationships between the parts. This is best evidenced by the manner in which many subjects handle the "feature profile." Still another type of response is one which may start with complete failure to take in the total situation, but which after a certain amount of trial-and-error manifestation, leads to sudden though often belated appreciation of the figure. Such performances are most frequently met with in the case of the hand assembly. Altogether, then, it may be said that the "object assembly" test has a particular clinical value because it reveals something about one's mode of perception, the degree to which one relies on trial-and-error methods, and the manner in which one reacts to mistakes. According to Wechsler:

It correlates least well with the Digit Span and best with the Block Design. Interestingly enough, the correlation with total score on the case of adults, rises significantly with an increasing age. Its "r" is .41 for ages 21-34 and .51 for ages 45-49. With respect to the particular abilities involved in this test, it would seem that older people react more nearly like children than do the average adults.²⁰

Block design. -- The "block design" test was originated by Kohs, who offered it as a comprehensive measure of non-verbal intelligence. It is hard to explain the basis for its merits other than that the reproduction of the type of design devised by Kohs in some way involves both synthetic and analytical ability. Curiously enough, individuals who do best on the test are not those who see, or at least follow, the pattern as a whole, but who are unable to break it up into small portions. In this connection, a recent study by Nadel on intellectual disturbances following certain (frontal lobe) brain lesions is of interest. He reports that, "... as between following the figure and breaking up the design into its component parts, the patients with frontal lobe lesions in contrast to the normal group used almost exclusively the former method."²¹

The test's value for diagnostic purposes is particularly worth mentioning. Patients with mental deterioration

²⁰Wechsler, op. cit., p. 97.

²¹A. B. Nadel, "A Quantitative Analysis of Behavior Following Cerebral Lesions," Archives of Psychology, No. 224.

and seniles have particular difficulty in managing the test and often cannot complete the simplest design, however much they try. So do most of the cases of brain disease. The difficulty here seems to be a certain lack in synthesizing ability, or loss of the abstract approach. In many cases of frontal lobe lesions, the patient's inability to reproduce the design could be explained in the basis of a loss of ability to shift. Some of the patients seemingly do not know when the designs are finished, others have particular difficulty in attending to the figure's color and pattern simultaneously, and still others, or the same patients, will get derailed at certain portions of the figures, apparently unable to synthesize the rest of the pattern with it. Whatever the mechanisms involved, the "block design" is one of the best subtests for showing up early as well as late disturbances in the higher perceptual processes.

In regard to the statistical evaluation of this particular subtest, Wechsler states:

With the possible exception of the Similarities and the Vocabulary, the Block Design correlates more highly with total score than any of our other tests including the verbal ones. Its "r" with total score (for ages 35-49) is .73. Its highest single correlations are .60 with Information (ages 35-49) and .57 with Picture Completion (ages 20-34). Its lowest correlations are with Object Assembly .32 (ages 20-43) and Picture Arrangement .37 (ages 35-49). These correlations are more like those obtained with the verbal than with the performance items of the scale. In spite of its high correlation, the test does not hold up well with age. Persons over 40 do progressively worse at it as they grow older. Considering

the fact that the test correlates highly with all measures of general intelligence, we interpret this decline as one of the best proofs of the natural falling off of intellectual ability with age. For the same reason it may be regarded as an excellent measure of deterioration, a conclusion which is amply confirmed by the study of individual cases.²²

Digit symbol. -- The "digit symbol" or substitution test is one of the oldest and best-established of all psychological tests. It is to be found in a large variety of intelligence scales, and its wide popularity is fully merited. The subject is required to associate certain symbols with certain other symbols, and the speed and accuracy with which he does this serve as a measure of his intellectual ability. In deciding upon its inclusion in the battery, Wechsler says that

. . . the only question in our minds was the degree to which the purely motor aspect of it might penalize the performance of adults. This motor factor turned out to be less important than originally suspected from certain points of view, and rather more important as regards certain others. In the case of illiterates who have not had practice in the use of pencil and paper, it is particularly disturbing. One does not ordinarily realize what a difficult task the formation of numerals and letters may be for a person who has never learned how to write. Such individuals approach the task much like a schooled person might when attempting to write the letters of a foreign tongue for the first time. The letters are not written but copied. Obviously, then, the test cannot be used on illiterates and in the examination of such individuals, it is omitted from our scale. In the case of literate older people, the problem is of a different order. Here the difficulty is not lack of familiarity with paper and pencil, but rather that of motor set and motor speed. To the extent to which these correlate with an actual loss in learning ability, the factors cannot, of course, be said to lessen the value of

²²Wechsler, op. cit., p. 94.

the test. But the question is whether motor speed does not have an independent and disturbing effect. The actual facts are these: the mean scores on the Digit Symbol Test begin to drop after 25, and after 35, and especially after 40, they taper off very markedly with age.²³

The performance on "digit symbol" implies visual activity, motor activity, and a learning process. The motor activity is of two kinds: first, the head and eye movements used in falling back upon the samples; and second, the writing and drawing movements used in the reproduction of the symbols.

The learning process is always abortive, because of the non-sense connection between digit and symbol. Even if learning is stressed by the subject, the performance usually remains of an attention character; that is, it exists -- as in "digit span" -- as a momentary noting rather than being integrated with the interests and general frame of reference of the individual.

The visual organizing function plays two different roles: first, as the channel of learning and remembering the digits and associated symbols; and second, as a guide in both the spatial-motor learning and the executive drawing and writing actions.

The visual-motor co-ordination in this subtest is expressed in the tuning together of the visual percept of the

²³Ibid., p. 95.

symbol and digit, the spatial-visual and spatial-motor orientation, and the executive half-habituated action of drawing. It is small wonder that such a delicate interaction is easily disturbed from any side.

First of all, anxious hesitancy and obsessive doubt impair the stability of visual organization and the percept of what is to be looked for, and where. Meanwhile, motor action becomes hesitant; and while, if the percept had been quickly acted upon, it would have served its purpose, in the course of hesitant movements preparatory to action, the visual guiding percept all but disintegrates, and time-consuming checks and re-checks follow. At times subjects, especially those whose anxiety and attention disturbance are considerable, compensate for a labile visual organization by jotting down the symbols with jerky rapidity, in order not to lose them. Thus not only visual and motor efficiencies tune together, but also their inefficiencies.²⁴

Related Studies

The early application of mental testing to the study of psychoses was primarily directed toward a determination of the extent of so-called deterioration caused by the disease process. A corollary to this problem was the investigation of the relationship between intelligence level

²⁴Rapaport, op. cit., p. 290.

and type of psychosis. In the course of testing for deficit, it was noted that vocabulary was relatively well preserved in psychotics even when other abilities declined, and leading from this new interest, there developed an inspection devoted to the broader relationship between verbal and non-verbal performance and psychosis. Finally, attention became directed to psychometric pattern, which refers to the relationships among the scores on a battery of tests.

J. R. Wittenborn concludes that among Rapaport's diagnostic groups a profile or scatter pattern analysis of Wechsler-Bellevue subtests is of no greater value as a psychometric supplement to diagnosis than an inspection of the subtests for a few conspicuous instances of failure and relative success.²⁵

Sol Garfield reports:

On the basis of the data presented in this study, it would appear that as yet there are no reliable scatter patterns on the Wechsler-Bellevue Scale for schizophrenic subjects. Not only was there a great deal of variability evident among the schizophrenic subjects as a group, but there was a large amount of overlapping between the schizophrenic and hospitalized control subjects. For practical diagnostic purposes in an institution, such a comparison is a more valid one than utilizing a group of normal subjects as a control group.²⁶

²⁵Wittenborn, op. cit., p. 439.

²⁶Sol L. Garfield, "A Preliminary Appraisal of Wechsler-Bellevue Scatter Patterns in Schizophrenia," Journal of Psychology, XII (1947), 35-36.

It was also found that some of the measures reported by previous investigators were not completely substantiated by these findings. Several possible interpretations can be offered for the variation in findings among the different investigators:

1. There is undoubtedly a large amount of variability in the types of schizophrenic subjects used in such studies. For example, Rapaport did not use any hebephrenic or catatonic schizophrenic subjects, and thus any generalization offered on the basis of his subjects will not hold true for the entire schizophrenic group. Also, the differences in diagnoses and diagnostic criteria used in different institutions are an important factor to consider in comparing such results.

2. Another important factor in explaining differences is undoubtedly the degree of illness of the particular patients used. Where long-standing cases of schizophrenia are used, undoubtedly much more intellectual impairment and variability will be found. The present group, perhaps, represents a larger sample of younger or earlier cases than is usually recorded. Until attention is given to extent or degree of illness, comparability of results will be hampered.

3. The time at which the patient is tested is another factor contributing to variability. Since schizophrenics

very often are variable in their behavior, the precise time at which they are tested is of some significance.

4. The degree of motivation and rapport secured with patients is another subjective factor which may influence test results.

Such factors contribute to the variations in findings from institution to institution, and until attempts are made to observe strictly similar conditions, it is doubtful that any generalized findings or patterns will be forthcoming that are applicable to any institution. When one evaluates the inconclusive patterns and critical findings of this study, as well as the significant discrepancies among the various studies already mentioned, it is apparent that at the present time there are no scientifically demonstrated scatter patterns. For this reason, caution must be used in attempting to apply such patterns for psychometric tests in various institutions.²⁷

In a study by Louis Levine of 294 patients admitted to the Veterans' Administration Hospital, Palo Alto, California, between January 1 and May 1, 1947, the following conclusions were made:

. . . results of this study indicate that the patterns have definite limitations as practical, clinical diagnostic devices. Though the agreement between the psychologists as to test diagnoses was

²⁷Ibid., p. 37.

statistically significant for nine of the ten pairs studied, the disagreement between them ranged from 17 through 32 per cent of the cases diagnosed. This disagreement suggests that the profiles overlap sufficiently to make discriminations between them both difficult and unreliable for some cases.²⁸

Lennart Johnson of the Chicago State Hospital, Chicago, Illinois, reports that schizophrenic patients do not present a consistent symptomatology on the Wechsler-Bellevue Intelligence Test.²⁹ Obtained test scatter exceeds the variability limits established by Wechsler. The "information," "picture arrangement," and "block design" subtests are the most confirmatory of Wechsler's limits, yet are verified by less than two thirds of the population.

Sex differences are not so apparent and would militate against a sex basis for interpreting test patterns. A notable male superiority is discernible on the "information" and "picture completion" subtests, probably a product of their more extensive environmental contacts and pressures.

There is a close correspondence between the achievements of the two schizophrenic populations. The test behavior of both groups extends the variability limits throughout the entire continuum of possible test scores.

²⁸Louis S. Levine, "The Utility of Wechsler's Patterns in the Diagnosis of Schizophrenia," Journal of Consulting Psychology, XIII (1948), 30.

²⁹Lennart C. Johnson, "Wechsler-Bellevue Pattern Analysis in Schizophrenia," Journal of Consulting Psychology, XIII (1948), 33.

In another study by Garfield, he states:

There does not appear to be any clear-cut psychometric pattern which can be labeled "schizophrenic." Where some trends seem to exist, comparable data for other psychopathological groups must be secured before anyone can consider the trends to be of diagnostic significance. In terms of present findings, therefore, one must be critical of attempts to devise and apply psychometric patterns based solely on broad nosological categories.³⁰

Mental deterioration is of importance in this study and, although little has been mentioned in regard to this item, investigators John R. Schlosser and Robert E. Kantor report that of 163 patients at the Veterans' Administration Hospital at Palo Alto, California, there is no significant statistical difference between the deterioration ratio of schizophrenic groups as contrasted with a psychoneurotic group, nor is there any significant statistical difference between the deterioration ratio of a paranoid schizophrenic group as contrasted with a residual schizophrenic group composed of the simple, catatonic, and hebephrenic groups.³¹

Organization of Data

The data for this study were organized into three chapters. Chapter I contains an introduction to the study,

³⁰Sol L. Garfield, "An Evaluation of Wechsler-Bellevue Patterns in Schizophrenia," Journal of Consulting Psychology, XIII (1948), 286.

³¹John R. Schlosser and Robert E. Kantor, "A Comparison of Wechsler's Deterioration Ratio in Psychoneurosis and Schizophrenia," Journal of Consulting Psychology, XIII (1948), 110.

including the purpose of the problem, scope of the study, procedure, definition of terms, psychological rationale of the Wechsler-Bellevue Intelligence Test subtests, and summaries of related studies. Chapter II contains an analysis of the testing results, while Chapter III gives a summary and the writer's conclusions and recommendations concerning the problem.

CHAPTER II

ANALYSIS OF TESTING RESULTS

This chapter is devoted to the statistical analysis of the data with particular emphasis devoted to the specific objectives of this investigation as outlined in Chapter I.

Verbal-performance Superiority

Intelligence quotients from the Wechsler-Bellevue Intelligence Test can be obtained not only for the full scale, but also for the verbal half and the performance half, and are called, respectively, Verbal IQ and Performance IQ. The intelligence quotients for the separate halves of the scale make allowance for age, just as does the full-scale intelligence quotient. To determine which half of the Wechsler contributes most to total intelligence quotient for schizophrenics, a comparison between mean Verbal IQ and mean Performance IQ is presented in Table I. The total group is separated into a younger age group, sixteen to thirty-seven years of age, and an older age group, thirty-nine to fifty-nine years, in order to note whether the picture is altered by age. Mean discrepancy is indicated by a plus sign (+) to show the superiority of the Verbal Scale or a minus sign (-) to designate superiority of the Performance Scale.

TABLE 1
VERBAL AND PERFORMANCE IQ DISCREPANCY

Comparable Items	Total Group: 62 Per- sons Aged 16-59 Years	Younger Group: 30 Per- sons Aged 16-37 Years	Older Group: 32 Per- sons Aged 39-59 Years
Mean Verbal IQ	90.12	89.50	91.05
Standard deviation	20.85	19.30	12.05
Mean Performance IQ	90.60	90.15	91.05
Standard deviation	21.35	17.05	15.75
Mean discrepancy	-.48	-.65	-.00

Both the total group and the younger schizophrenics show a slightly superior mean on the Performance Scale, but the Critical Ratio of the difference between Performance IQ and Verbal IQ is only 0.99 for the former group and 0.10 for the latter group and therefore does not satisfy the criterion for significance. There is no difference between Verbal and Performance means for the view that schizophrenic patients do better on the Verbal phase, as Wechsler¹ and Rabin² have reported; nor has a division of the total group

¹Wechsler, op. cit., pp. 72-75.

²A. I. Rabin, "Test Score Patterns in Schizophrenia and Nonpsychotic States," Journal of Psychology, XII (1941), 91-100.

into younger and older classifications revealed any different trend as Weider³ has shown. This lack of significant difference between Verbal and Performance IQ is, however, in agreement with the results of Margaret and Wright.⁴

Comparison of Test Scores and
Patterns of Schizophrenics
and Normals

Table 2 presents the scores made by schizophrenics and normals on the various subtests of the Wechsler Scale, while Figure 1 graphically compares these test patterns. A shift is evident in the pattern for both subjects and controls with increasing age as well as differences in the same groups. The younger schizophrenics and normals are significantly differentiated by their performance on Comprehension, Similarities, Picture Completion, and Digit Symbols since the disparity between scores would occur only in a fraction of one per cent of cases by chance, according to Fisher's table of "t."⁵ The lower ratings by the schizophrenics on the Picture Arrangement and Arithmetic subtests are also highly significant, and whereas the differences

³A. Weider, "Effect of Age on the Bellevue Intelligence Scale in Schizophrenic Patients," Psychiatric Quarterly, XVII (1943), 337-345.

⁴A. Margaret and C. Wright, "Limitations in the Use of Intelligence Test Performance to Detect Mental Disturbance," Journal of Applied Psychology, XXVII (1943), 387-398.

⁵Charles G. Peters and Walter R. Van Voorhis, Statistical Procedures and Their Mathematical Bases, pp. 171-176.

TABLE 2

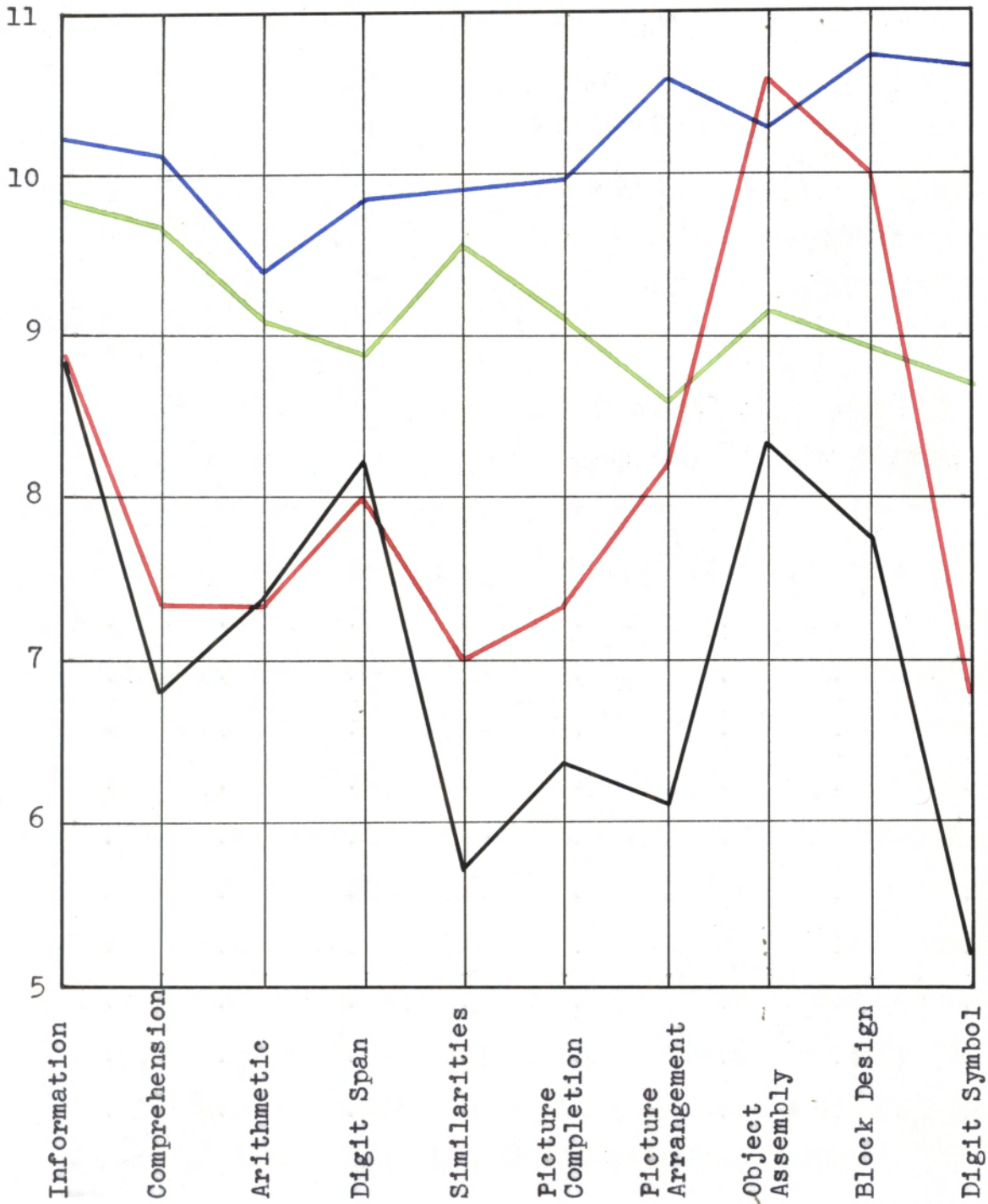
DISTRIBUTION OF MEANS, STANDARD DEVIATIONS,
AND t-SCORES FOR SCHIZOPHRENICS AND
NORMALS ACCORDING TO AGE GROUPS

Subtests	Total Schizo- phrenics (62 Persons)		Younger	
			Schizophre- nics (30 Per- sons)	
	Mean	Stand- ard Devia- tion	Mean	Stand- ard Devia- tion
Information	8.88	2.07	8.9	2.4
Comprehension	7.03	2.42	7.3	2.3
Arithmetic	7.25	3.37	7.3	3.0
Digit Span	8.22	3.24	8.1	3.1
Similarities	6.38	2.13	7.0	2.1
Picture Completion	6.91	2.80	7.4	3.0
Picture Arrangement	7.09	3.27	8.1	3.3
Object Assembly	9.47	3.32	10.5	3.1
Block Design	8.91	2.74	10.0	2.9
Digit Symbol	6.00	1.91	6.9	1.2

TABLE 2 -- Continued

Group, 16-37 Yrs.			Older Group, 39-59 Years				
Normals (345 Persons)		t	Schizophrenics (32 Persons)		Normals (345 Persons)		t
Mean	Standard Deviation		Mean	Standard Deviation	Mean	Standard Deviation	
10.3	2.9	2.3	8.9	2.0	9.8	3.3	1.8
10.2	3.0	4.8	6.8	2.4	9.7	3.3	4.8
9.4	2.9	2.6	7.3	3.5	9.1	3.4	2.0
9.8	3.0	2.1	8.4	3.2	8.7	3.0	.4
9.9	2.2	5.8	5.8	1.9	9.5	2.9	7.4
9.9	2.9	3.1	6.5	2.3	9.1	3.3	4.3
10.5	3.0	2.7	6.1	2.8	8.5	3.3	3.4
10.2	3.0	.4	8.4	3.3	9.1	3.3	.8
10.7	2.9	1.0	7.8	2.2	8.9	3.3	1.8
10.7	2.9	13.0	5.3	1.8	8.6	3.3	6.6

Mean Score



- Normals, aged 16-37 years
- Normals, aged 39-59 years
- Schizophrenics, aged 17-29
- Schizophrenics, aged 30-49

Fig. 1. -- Mean scores of subtests for schizophrenic and nonpsychotic groups.

between subjects and normals appear slight on Digit Span and Information, these differences are at the five per cent level of significance. The small differences in scores on the Object Assembly and Block Design tests are not statistically significant. Between the older groups, the relative inferiority of the schizophrenics on the Digit Symbol, Picture Arrangement, Picture Completion, Similarities, and Comprehension subtests is highly significant, since the differences are at the one per cent level of significance. On the remaining five subtests, a comparison of performance by schizophrenics and normals fails to yield statistically significant differences.

Judging from the mean educational level of the schizophrenic subjects, one might infer that some deficit is obvious in their efficiency, but this is merely conjecture; there is no definite proof regarding this point. But the fact that the psychotic group functions at a lower level of performance than the normals, whatever the cause, does not affect comparisons in terms of which tests rate best, and which poorest within each of the groups. One method of comparison which eliminates any difficulties engendered by the discrepancies in specific scores is to convert all mean scores into rank orders. The subtest scoring highest receives the rank of 1, that subtest scoring lowest gets a rank of 10, and accordingly for the other ranks. Table 3 presents

a comparison of schizophrenics and normals in terms of such rank orders.

TABLE 3
COMPARISON OF RANK ORDER OF SUBTEST MEANS FOR
SCHIZOPHRENICS AND NORMALS ACCORDING TO
AGE GROUPS

Subtests	Schizo- phren- ics, Total 62	Age			
		16-37 Years		39-59 Years	
		Schizo- phrenics (30 Per- sons)	Normals (345 Per- sons)	Schizo- phrenics (32 Per- sons)	Normals (345 Per- sons)
Information . .	3	3	4	1	1
Comprehension .	7	7.5	5.5	6	2
Arithmetic . .	5	7.5	10	5	5
Digit Span . .	4	4.5	9	2.5	8
Similarities .	9	9	7.5	9	3
Picture Com- pletion . .	8	6	7.5	7	5
Picture Ar- rangement .	6	4.5	3	8	10
Object Assembly	1	1	5.5	2.5	5
Block Design .	2	2	1.5	4	7
Digit Symbol .	10	10	1.5	10	9

From Table 3 it is evident that the Digit Symbol test distinguishes most clearly between the psychometric patterns of younger schizophrenics and younger normals; for the former this is their poorest test; for the latter, one of their best. Distinct differences between the two groups are also obvious in the rank orders assigned Object Assembly and Digit Span, whereas the other tests fail to show major disagreement. The older schizophrenics and normals differ in their placement on Comprehension, Similarities, and Digit Span and are fairly alike on the other subtests.

The Digit Symbol test, which involves the formation of new associations within a very short time, offers a most interesting picture. Normals decline sharply in such ability with advancing age, whereas the schizophrenics consistently rate lowest. This would suggest that we are dealing with an ability which becomes severely impaired by both the schizophrenic process and normal advancing age. Comprehension and Similarities assume high ranks as the normal group moves from the younger to the older range, but for schizophrenics, the two tests persist at a low level. Apparently the social judgment involved in the Comprehension test and the ability to ignore superficial differences and to note essential but more abstract likenesses required by Similarities are functions which are affected by schizophrenia so that the normal increased proficiency with older

age does not occur. Object Assembly and Digit Span are maintained at approximately similar relative positions between psychotic and nonpsychotic groups.

**Comparisons of Schizophrenia Patterns as
Determined by Various Investigators**

The method of assigning rank order to mean scores of the subtests makes it possible to compare the results obtained in this study with those reported by other investigators who tested schizophrenic patients with the Wechsler-Bellevue Scale. Table 4 sets up a comparison of findings for younger and older age groups. The investigator, age range of patients and number of cases are noted for each study.

The data obtained in this study agrees with both Rabin⁶ and Weider⁷ in finding a superiority of the younger schizophrenics on the Information test, average ability on Picture Arrangement and Picture Completion, and inferior performance on Digit Symbol. There is confirmation of Rabin's low ranking for Similarities, but agreement with Weider on Arithmetic and Digit Span. This study, however, finds relatively poor Comprehension, whereas Rabin and Weider rate this highest and second highest, respectively, and finds relatively

⁶A. I. Rabin, "Use of the Wechsler-Bellevue Scales with Normal and Abnormal Persons," Psychological Bulletin, XLIII (1945), 410-422.

⁷Weider, op. cit., pp. 337-345.

TABLE 4

COMPARISON OF RANK ORDER OF SUBTEST MEANS
FROM VARIOUS INVESTIGATORS

Subtests	Younger Groups		
	Rabin, 19 Persons, Age 18-25	Weider, 20 Persons, Age 16-28	Present Study, 30 Persons, Age 16-37
Information	1	3	3
Comprehension	2	1	7.5
Arithmetic	3	7	7.5
Digit Span	8	4	4.5
Similarities	7	2	9
Picture Completion .	6	8	6
Picture Arrangement .	4	5	4.5
Object Assembly . . .	10	9	1
Block Design	5	6	2
Digit Symbol	9	10	10

TABLE 4 -- Continued

Older Groups			
Magaret, 30 Persons, Age 30-40	Weider, 30 Persons, Age 31-49	Present Study, 32 Persons, Age 39-59	Rapaport, 7 Persons, Age 25-55
1	3	2	2
6	1.5	6	6
8.5	8	5	7
5	5.5	2.5	5
4	1.5	9	3.5
7	5.5	7	9
8.5	9	8	10
2	7	2.5	1
3	4	4	3.5
10	10	10	8

good performance on Object Assembly and Block Design, on which tests Rabin and Weider report poor ability. The last three mentioned differences are in agreement with Magaret's⁸ findings which are based on slightly older subjects, and Rapaport's⁹ results.

Most studies have consistently pointed to poor performance on questions involving practical judgment, such as the Comprehension test demands, so that the reports of Magaret, Rapaport, and this study are further evidence on this point, whereas Rabin's and Weider's reports are contrary to the usual results. Rabin's study on retests of schizophrenics reveals an extremely low correlation between initial and subsequent standing on Comprehension, and it may be that the divergencies among reports by different investigators merely reflect the marked fluctuations characteristic of schizophrenics on this particular test.¹⁰ The relative superiority on Object Assembly and Block Design noted in this work and that by Magaret and Rapaport in contradistinction to the inferior ranks assigned by Weider and Rabin cannot be explained by this investigator.

⁸A. Magaret, "Parallels in the Behavior of Schizophrenic, Paretic, and Pre-senile Non-psychotics," Journal of Abnormal and Social Psychology, XXXVII (1943), 511-528.

⁹Rapaport, op. cit., pp. 299-301.

¹⁰A. I. Rabin, "Differentiating Psychometric Patterns in Schizophrenia and Manic-depressive Psychosis," Journal of Abnormal and Social Psychology, XXXVII (1942), 270-272.

Turning attention to the older schizophrenics, there is unanimity of agreement of superiority on Information and Block Design and inferiority on Picture Arrangement and Digit Symbol. Furthermore, there is perfect consistency with the report of Magaret that schizophrenics do very well on Object Assembly and poorly on Picture Completion and Comprehension. Slightly better performance upon Arithmetic and Digit Span and less ability on Similarities are recorded for the schizophrenics of this study than by either Magaret, Weider, or Rapaport.

The differences in ranking in Arithmetic and Digit Span are comparatively unimportant. Similarities, however, differs sharply, but the investigator's data agree in this instance with Rabin's report on the younger group and with Wechsler's clinical impressions. Since success on Similarities involves the ability to disregard easily apparent differences and infer less obvious generalizations, analogous to the requirements of the sorting tests used by Vigotsky,¹¹ Goldstein,¹² and Hanfmann and Kasanin,¹³ the relatively poor performance of schizophrenics on this test is in keeping

¹¹L. S. Vigotsky, "Thought in Schizophrenia," Archives of Neurological Psychiatry, XXXI (1934), 1063-1077.

¹²K. Goldstein, "Significance of Psychological Research in Schizophrenia," Contemporary Psychopathology, edited by S. Tomkins et al., 1943, pp. 302-318.

¹³E. Hanfmann and J. Kasanin, "Conceptual Thinking in Schizophrenia," Nervous and Mental Disorder Monograph, No. 67, 1940.

with the results noted on the sorting tests by the above investigators.

Variability or Scatter in Schizophrenic Performance

By obtaining the arithmetic sum of the mean deviation scores for each of the two schizophrenic and normal groups, some measure of the over-all variability of their performance may be noted. When this is done, the following results:

Younger schizophrenics	9.8
Older schizophrenics	10.3
Younger normals	3.2
Older normals	3.4

Thus the variability of the schizophrenics is greater than that of the normals. This conclusion of greater intertest variability for schizophrenics is in harmony with Magaret,¹⁴ Wechsler,¹⁵ and Rabin¹⁶ and offers additional disagreement with Gilliland *et al.*¹⁷

Schizophrenia as a Premature Aging Process

The hypothesis that schizophrenia resembles "premature

¹⁴Magaret, *op. cit.*

¹⁵Wechsler, *op. cit.*, pp. 101-3.

¹⁶Rabin, *op. cit.*

¹⁷A. R. Gilliland, P. Whittman, and M. Goldstein, "Patterns and Scatter of Mental Abilities in Various Psychoses," *Journal of Genetic Psychology*, XXIX (1943), 251-260.

aging," proposed by Margaret¹⁸ and refuted by Rabin, is examined here on the basis of the performance of the schizophrenics in this study. Table 5 indicates those tests which "hold up" and "do not hold up" for the total group of

TABLE 5
TESTS WHICH "HOLD UP" AND "DO NOT HOLD UP"
IN SCHIZOPHRENICS AND IN OLD AGE

Schizophrenics	Normal Old Age (Wechsler)	Normal Old Age (Rabin)
<u>Hold Up</u>		
Object Assembly	Information	Information
Block Design	Comprehension	Comprehension
Information	Object Assembly	Similarities
Digit Span	Picture Completion	Digit Span
Arithmetic		
<u>Do Not Hold Up</u>		
Digit Symbol	Digit Span	Digit Symbol
Similarities	Arithmetic	Picture Arrangement
Picture Completion	Digit Symbol	Block Design
Comprehension	Block Design	Picture Completion
Picture Arrangement	Similarities	
	Picture Arrangement	

¹⁸Margaret, op. cit., pp. 511-528.

schizophrenics and for old age in normals as given by Wechsler¹⁹ and Rabin.²⁰

Comparing Wechsler's arrangement for old age with that of schizophrenics, there is agreement on placement of Object Assembly, Information, Digit Symbol, Similarities, and Picture Arrangement. The other tests are assigned opposite categories. With Rabin's old-age group, the schizophrenics show similarity on Information, Digit Span, Digit Symbol, Picture Arrangement, and Picture Completion. Thus, there is a resemblance in trend for schizophrenia and old age in normals on about half of the tests, and no similarity for the others.

Another method of testing this conception of "premature aging" in schizophrenia is to compare the mean deviation from the mean scores of schizophrenics and older age normals for evidence of similarity on direction change. Table 6 represents the mean deviation scores for the younger schizophrenics of this study, the older normals of Wechsler's standardization population, and the mean deviations reported by Rabin²¹ for an aged group of normals ranging from sixty to eighty-four years.

¹⁹Wechsler, op. cit., p. 93.

²⁰Rabin, op. cit., p. 273.

²¹A. I. Rabin, "Psychometric Trends in Senility and Psychoses of the Senium," Journal of Genetic Psychology, XXXII (1943), 149-162.

TABLE 6

**COMPARISON OF MEAN DEVIATION SCORES OF YOUNG
SCHIZOPHRENICS AND OLDER NORMALS**

Subtests	Normals, Age 30-49 (Wechsler)	Normals, Age 60-84 (Rabin)	Schizophren- ics, Age 16-37
Information	0.7	2.8	0.8
Comprehension	0.6	2.4	-0.8
Arithmetic	0.0	0.1	-0.8
Digit Span	-0.4	0.4	0.0
Similarities	0.4	0.6	-1.1
Picture Completion . .	0.0	-0.6	-0.7
Picture Arrangement . .	-0.6	-2.4	0.0
Object Assembly	0.0	-0.4	2.4
Block Design	-0.2	-0.6	1.9
Digit Symbol	-0.5	-2.6	-1.3

While Rabin's psychometric data on an older group of normals furnishes proof that the timed performance tests decline concurrently with age, whereas some factor or factors other than time are operative in schizophrenia, the hypothesis that the schizophrenic process may bear some resemblance to advancing age is not disproved and deserves further examination.

CHAPTER III

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

Sixty-two schizophrenic patients at the Terrell State Hospital, Terrell, Texas, were tested on the Wechsler-Bellevue Intelligence Scale and their psychometric performance analyzed. Many factors, such as smallness of the sample, inclusion of all types of schizophrenia in a single category, and a wide age, educational, and intelligence range for the subjects, limit somewhat the significance of the statistical results in terms of conclusions. Nevertheless, the results do add materially to the several studies that have been carried on in the field of psychometric patterns in schizophrenia. Within the boundaries of this study, the following results were found:

1. There is no significant statistical difference between the intelligence quotients of schizophrenic subjects as determined by the Performance and the Verbal Scales of the Wechsler-Bellevue Scale.

2. Highly significant differences between younger schizophrenics and normals were obtained on test scores for the Digit Symbol, Comprehension, Similarities, and Picture

Completion tests. Between the older groups, differences in scores on these four tests plus the Picture Arrangement test were found to be statistically significant.

3. The psychometric pattern for young schizophrenics is as follows, with the tests listed in the order of their relative difficulty, starting with the easiest and progressing to the hardest: Object Assembly, Block Design, Information, Digit Span, Picture Arrangement, Picture Completion, Arithmetic, Comprehension, Similarities, and Digit Symbol.

The psychometric pattern for older schizophrenics is: Information, Digit Span, Object Assembly, Block Design, Arithmetic, Comprehension, Picture Completion, Picture Arrangement, Similarities, and Digit Symbol.

4. The schizophrenic pattern obtained is compared with results reported by Magaret, Weider, Rabin, Rapaport, and Wechsler.

5. Variability in test performance is considerably greater for schizophrenics of this study than for Wechsler's normal groups.

6. The schizophrenic process and normal advancing age produce similar effects on approximately half of the subtests of the Wechsler-Bellevue Scale.

Conclusions

On the basis of the data presented in this study, it would appear that as yet there are no reliable scatter

patterns on the Wechsler-Bellevue Scale for schizophrenic subjects. Not only was there a great deal of variability evident among the schizophrenic subjects as a group, but there was a large amount of overlapping between the schizophrenic and hospitalized control subjects. For practical diagnostic purposes in an institution, such a comparison is a more valid one than utilizing a group of normal subjects as a control group. It was also found that some of the measures reported by previous investigators were not completely substantiated by these findings.

There is undoubtedly a large amount of variability in the types of schizophrenic subjects used in such studies. For example, Rapaport did not use any hebephrenic or catatonic schizophrenic subjects, and thus any generalization offered on the basis of his subjects will not hold true for the entire schizophrenic group. Also, the differences in diagnosis and diagnostic criteria used in different institutions are important factors to consider in comparing such results.

Another important factor in explaining differences is undoubtedly the degree of illness of the particular patients used. Where long-standing cases of schizophrenia are used, undoubtedly much more intellectual impairment and variability will be found.

The time at which the patient is tested is another factor contributing to variability. Since schizophrenics very often are variable in their behavior, the precise time at which they are tested is of some significance.

The degree of motivation and rapport established with patients is another subjective factor which may influence test results.

Recommendations

This study of individual subtest deviations, similar to previously reported analyses, reveals considerable variation in the patterns of schizophrenic patients. So many factors contribute to the variations in findings from institution to institution, and until attempts are made to observe strictly similar conditions, it is doubted that any generalized findings or patterns will be forthcoming that are applicable to any institution. When one evaluates the inconclusive patterns and critical findings of this study, as well as the significant discrepancies among the various studies already mentioned, it is apparent that at the present time there are no scientifically demonstrated scatter patterns. For this reason, caution must be used in attempting to apply such patterns for psychometric tests in various institutions.

APPENDIX

DIRECTIONS FOR THE INDIVIDUAL TESTS¹

General Information. -- Read questions as stated and in order given. The first question, "Who is President of the United States?" is used as a buffer and not scored. Most of the questions are easily marked right (✓) or wrong (-), but the examiner should familiarize himself with the right answers. Ordinarily, it will be possible to score a response directly plus or minus, but when the subject's answers are doubtful they should be written out. It is always legitimate to say, "Explain more fully," but not to give leading questions. The questions are as follows:

(a) Who is the president of the United States?

1. Who was the president before him?
2. What is a thermometer?
3. What does rubber come from?
4. Where is London?
5. How many pints make a quart?
6. How many weeks are there in a year?
7. What is the capital of Italy?
8. What is the capital of Japan?

¹Reproduced from David Wechsler, Measurement of Adult Intelligence, pp. 172-186.

9. How tall is the average American woman?
10. Who invented the airplane?
11. Where is Brazil?
12. How far is it from Paris to New York?
13. What does the heart do?
14. Who wrote Hamlet?
15. What is the population of the United States?
16. When is Washington's birthday?
17. Who discovered the North Pole?
18. Where is Egypt?
19. Who wrote Huckleberry Finn?
20. What is the Vatican?
21. What is the Koran?
22. Who wrote Faust?
23. What is an habeas corpus?
24. What is Ethnology?
25. What is the Apocrypha?

General Comprehension. -- Be sure that the subject is attending when you give the questions. Very young and very old subjects sometimes find it difficult to remember the entire question from a single statement of it. It is, therefore, always permissible to repeat the question. In fact, it is a good practice to repeat the question, if no response is obtained after 10 or 15 seconds, but do not abbreviate or alter the wording. Record subject's responses verbatim.

Sometimes it is necessary to encourage the subject. It is done with such remarks as, "Yes," "Go ahead," etc. If response is not clear, add, "Please explain further." Except for low-grade individuals, ask all the questions.

Arithmetical Reasoning. -- There are 10 problems, the first 8 of which are given orally and the last 2 handed to the subject on a printed card with the instructions, "Now read this one aloud and do the problem mentally." In the case of young children and subjects likely to be defective, it is well to begin with the first example, but with bright children and average adults, it is better to begin with a problem which the examiner has reason to believe the subject will solve readily, but which is not "too easy." With an average adult one may begin with problem 3, allowing credit for the easier problems. Continue downward until three successive examples are failed. In presenting the first problem say, "I want to see how good you are in arithmetic." The wording of the question may not be altered, but it is always permissible to repeat the problem. In fact, it is desirable to do so to make sure that the subject is not forgetting it in the process of trying to solve the example. The first five problems are solved almost immediately by subjects who know the correct answers, but liberal time is allowed. If the subject does not answer within the time limit, proceed with the succeeding questions, saying, "Now try this one."

Digits Forward and Backward. -- These are administered as separate tests, but the number of digits correctly reproduced on each are added to give a total score.

(a) Digits Forward: Say, "I am going to say some numbers. Listen carefully, and when I am through, say them right after me." If subject repeats series correctly, mark plus and continue with next higher one. If subject fails, give second trial on series of equal length. Discontinue after subject has failed on both trials of a given series. Score is highest number of digits repeated without error on either of two trials. Thus, if subject repeats correctly 5 digits forward, he gets a score of 5. Read digits at rate of one per second.

(b) Digits Backward: Say, "Now I am going to say some more numbers, but this time when I stop, I want you to say them backwards. For example: if I say 7-1-9, you say (pause) 9-1-7." If subject gives them correctly, say, "That's right." If subject does not seem to understand, use another example. Always begin with the 3-digit series, continuing until subject fails both trials of the series. If subject fails the 3-digit series, it is permissible to give him the 2-digit series and allow him a 2 score if he is able to reverse them. Only use the 2-digit series when there is failure on both of the 3-digit series. Score is the highest number of digits correctly reversed.

Picture Arrangement. -- Present first sample series in mixed order as indicated on back of the card. Say, "The pictures tell a story about a bird building its nest. As you see, they are in the wrong order, but if you put them in the right order -- like this [the examiner starts rearranging the cards] -- the pictures will tell a sensible story. Watch me. In the first picture the bird is building its nest, the next picture shows the eggs which the bird has laid, and the last picture shows the bird feeding its young which have been hatched. [Pause.] Now I have some other sets of pictures which I want you to arrange. In each case they are mixed up and what I want you to do is to put them in the right order so that they make the most sensible story. Try this set."

Picture Completion. -- There are 15 cards in this test, each of which has a part missing. The cards are presented to the subject in numerical order, and he is asked to name or indicate on each card the missing part. Prior to the presentation of the first card, the examiner says, "I am going to show you some pictures in which there is a part missing. I want you to look at each picture carefully and tell me what it is. Now look at this one. [Presenting card No. 1.] What important part is missing?" If correct answer is given continue with succeeding pictures, saying,

"Now what is missing in this one?" If the subject fails to detect omission, indicate to him, thus, "You see, the nose is missing." If he fails on the second picture also, he is helped again, thus, "You see here half of the mustache is missing." But beginning with the third picture no further help is given, the examiner merely repeating the formula, "Now what is missing in this picture?" at each successive presentation. Sometimes the subject mentions an unessential missing part. The first time this occurs, the examiner may say, "Yes, but what is the most important thing missing?" The examiner may not repeat this comment for the remaining presentations. Allow a maximum exposure of 15" to 20" per picture. If the subject does not indicate the missing part within this time, score as failure and continue with the succeeding picture. Except for very low-grade individuals, present the entire series of pictures.

Object Assembly. -- There are three different items on this test; a Manikin, a Profile, and a Hand. Present these in order named, making sure that they have been arranged beforehand in a mixed fashion.

(a) Manikin: Say, "If these pieces are put together correctly they will form something. Go ahead and put them together just as quickly as you can."

(b) Profile: "Put this together as quickly as you can."

(c) Hand: Say, "Put this together as quickly as you can."

Block Design. -- This requires a box of 16 cubes and 9 designs, two of which are samples. Remove four cubes from the box and say: "You see, these blocks are painted different colors on the different sides. One side is blue, one red, one white, one yellow, one red and white, one blue and yellow. And all the blocks are exactly alike." The examiner next places Demonstration Card I in front of subject and says: "Now I want you to make me a design with the blocks so that it will look like the drawing on this card." "Notice that the drawing is all red; so, to make one just like it with these four blocks I would have to arrange them this way." (Illustrating.) "Do you understand?" (Pause.) "Well, let's try another. This one is more difficult." Examiner assembles blocks to make design shown on Card II, pausing to make clear to subject how two half designs can be put together to make one solid patch of color. When reasonably sure that subject understands, examiner presents Card I and says, "Now you take these 4 blocks and put them together so they'll make a design (picture) like the one you see on this card. Go ahead." When subject has finished with design, remark, "That's pretty good." Brush up the blocks, place second design before him, saying, "Now make me one like this." Proceed with cards in order until

design (5) is reached, when examiner puts 5 more blocks out and says, "Now make me one like this, using 9 blocks." When design (7) is reached, examiner takes out the remaining 7 blocks and says, "Now make me one like this using 16 blocks." Continue presenting designs in numbered order until subject has failed three consecutive ones. Help or further demonstration on designs other than that given on Demonstration Cards I and II is not permissible.

It is not uncommon for some subjects, particularly children, when making the first design either to rotate the pattern or to reverse color and background. When this happens, say, "Is this right, does it look just like the design?" and pause for a while. Usually the subject will make a spontaneous correction or will do it if the instructions are repeated. Reversals and rotations appear to be "normal" phenomena.

Digit Symbol. -- "Look at these divided boxes or squares (pointing to key); notice that each has a number on the upper part and a little mark on the lower part. Also, that with every number there is a different mark. Now, look here (pointing to sample), where the boxes have only numbers, and the squares underneath are empty. I want you to put in each of these squares (pointing) the little mark that should go there, like this." (The examiner points alternately to key and to the digit.) "Here is a 1, so you put in this

mark. This is a 3; therefore, you would put in this mark," etc. After doing five of the samples, pause and ask, "Now what should I put here?" (indicating the next empty square). If subject fails, examiner tells him and repeats question with next sample. After finishing the demonstration, examiner says, "Now you begin here and fill as many squares as you can. Do one right after the other, without skipping."

Vocabulary Test. -- Examiner says, "I want to see about how many words you know. Listen carefully and tell me what these words mean. Apple -- what does apple mean? Donkey -- what does donkey mean?" Then proceed with words listed in order, repeating at each presentation the formula, "What does _____ mean?" With more intelligent subjects, the phrase, "What does _____ mean?" may be omitted after the third presentation.

WECHSLER-BELLEVUE INTELLIGENCE SCALE

FOR ADOLESCENTS AND ADULTS

RECORD
FORM **I**

NAME _____ AGE _____ EDUC. _____ DATE OF EXAM. _____ NO. _____
 OCCUP. _____ NAT. _____ BIRTHDATE _____ COLOR _____
 PLACE OF EXAM. _____ EXAM. BY _____ PREVIOUS EXAM. _____

TABLE OF WEIGHTED SCORES†											
Equivalent Weighted Score	RAW SCORE										Equivalent Weighted Score
	Information	Comprehension	Digit Span	Arithmetic	Similarities	Vocabulary	Picture Arrangement	Picture Completion	Block Design	Object Assembly	
18	25	20		14	23-24	41-42	20+		38+		18
17	24	19	17	13	21-22	39-40	20		38		17
16	23	18	16	12	20	37-38	19		35-37	26	17
15	21-22	17		11	19	35-36	18	15	33-34	24	16
14	20	16	15		17-18	32-34	16-17	14	30-32	23	15
13	18-19	15	14	10	16	29-31	15	13	28-29	22	14
12	17	14		9	15	27-28	14	12	25-27	20-21	13
11	15-16	12-13	13		13-14	25-26	12-13		23-24	19	12
10	13-14	11	12	8	12	22-24	11	11	20-22	18	11
9	12	10	11	7	11	20-21	10	10	18-19	17	10
8	10-11	9			9-10	17-19	9	9	16-17	16	9
7	9	8	10	6	8	15-16	7-8	8	13-15	14-15	8
6	7-8	7	9	5	7	12-14	6	7	11-12	13	7
5	6	5-6			5-6	10-11	5		8-10	12	6
4	4-5	4	8	4	4	7-9	4	6	6-7	10-11	5
3	2-3	3	7	3	3	5-6	2-3	5	3-5	9	4
2	1	2	6		1-2	3-4	1	4	1-2	8	3
1	0	1		2	0	1-2	0	3	0	7	2
0		0	5	1		0		2		5-6	1
										0-3	0

SUMMARY		
TEST	R.S.	WT.S.
INFORMATION		
COMPREHENSION		
DIGIT SPAN		
ARITHMETIC		
SIMILARITIES		
(VOCABULARY)	()	()
VERBAL SCORE*		
P. ARRANGEMENT		
P. COMPLETION		
BLOCK DESIGN		
OBJECT ASSEMBLY		
DIGIT SYMBOL		
PERFORMANCE SCORE*		
TOTAL SCORE		
*Proration is necessary if four or six Verbal tests are given or four Performance tests.		
VERBAL SCALE	I.Q.	
PERFORM. SCALE	I.Q.	
FULL SCALE	I.Q.	

†Clinicians who wish to draw a "psychograph" on the above table may do so by connecting the appropriate raw scores; however, one must recognize the relative unreliability of these subtest scores when they are thus treated.

TEST ANALYSIS AND OBSERVATIONS

1.	INFORMATION	Score
	(PRESIDENT)	
1	BEFORE	
2	THERMOMETER	
3	RUBBER	
4	LONDON	
5	PINTS	
6	WEEKS	
7	ITALY	
8	JAPAN	
9	HEIGHT	
10	PLANE	
11	BRAZIL	
12	PARIS	
13	HEART	
14	HAMLET	
15	POPULATION	
16	WASHINGTON	
17	POLE	
18	EGYPT	
19	H. FINN	
20	VATICAN	
21	KORAN	
22	FAUST	
23	H. CORPUS	
24	ETHNOLOGY	
25	APOCRYPHA	

2.	COMPREHENSION	Score
1	ENVELOPE	
2	THEATER	
3	BAD COMPANY	
4	TAXES	
5	SHOES	
6	LAND IN CITY	
7	FOREST	
8	LAWS	
9	MARRIAGE	
10	DEAF	

3.	DIGITS FORWARD	DIGITS BACKWARD
5, 8, 2		6, 2, 9
6, 9, 4		4, 1, 5
6, 4, 3, 9		3, 2, 7, 9
7, 2, 8, 6		4, 9, 6, 8
4, 2, 7, 3, 1		1, 5, 2, 8, 6
7, 5, 8, 3, 6		6, 1, 8, 4, 3
6, 1, 9, 4, 7, 3		5, 3, 9, 4, 1, 8
3, 9, 2, 4, 8, 7		7, 2, 4, 8, 5, 6
5, 9, 1, 7, 4, 2, 8		8, 1, 2, 9, 3, 6, 5
4, 1, 7, 9, 3, 8, 6		4, 7, 3, 9, 1, 2, 8
5, 8, 1, 9, 2, 6, 4, 7		9, 4, 3, 7, 6, 2, 5, 8
3, 8, 2, 9, 5, 1, 7, 4		7, 2, 8, 1, 9, 6, 5, 3
2, 7, 5, 8, 6, 2, 5, 8, 4		
7, 1, 3, 9, 4, 2, 5, 6, 8		

5.	SIMILARITIES	Score
1	ORANGE — BANANA	
2	COAT — DRESS	
3	DOG — LION	
4	WAGON — BICYCLE	
5	PAPER — RADIO	
6	AIR — WATER	
7	WOOD — ALCOHOL	
8	EYE — EAR	
9	EGG — SEED	
10	POEM — STATUE	
11	PRAISE — PUNISHMENT	
12	FLY — TREE	

4.	ARITHMETIC			
	T	RorW	SC.	
1	{15"}			6 {30"}
2	{15"}			7 {60"}
3	{15"}			8 {60"}
4	{30"}			9 {120"}
5	{30"}			10 {120"}

5A. VOCABULARY	Score	
1 APPLE		
2 DONKEY		
3 JOIN		
4 DIAMOND		
5 NUISANCE		
6 FUR		
7 CUSHION		
8 SHILLING		
9 GAMBLE		
10 BACON		
11 NAIL		
12 CEDAR		
13 TINT		
14 ARMORY		
15 FABLE		
16 BRIM		
17 GUILLOTINE		
18 PLURAL		
19 SECLUDE		
20 NITROGLYCERINE		
21 STANZA		
22 MICROSCOPE		
23 VESPER		
24 BELFRY		
25 RECEDE		
26 AFFLICTION		
27 PEWTER		
28 BALLAST		
29 CATACOMB		
30 SPANGLE		
31 ESPIONAGE		
32 IMMINENT		
33 MANTIS		
34 HARA-KIRI		
35 CHATTEL		
36 DILATORY		
37 AMANUENSIS		
38 PROSELYTE		
39 MOIETY		
40 ASEPTIC		
41 FLOUT		
42 TRADUCE		
RT.	½ RT.	TOTAL

	TOTAL		½ RT.		RT.
--	-------	--	-------	--	-----

6	2	5	1	9	2	8	3	7	4	6	5	9	4	8	3	7	2	6	1	5	4	6	3	7
1	5	4	2	7	6	3	5	7	2	8	5	4	6	3	7	2	8	1	9	5	8	4	7	3
2	1	3	1	2	4	3	5	3	1	2	1	3	2	1	4	2	3	5	2	3	1	4	6	3

Sample



10. DIGIT SYMBOL TEST

6. PICTURE ARRANGEMENT			
	T	ORDER	SC.
1 HOUSE (1')			
2 HOLD UP (1')			
3 ELEVATOR (1')			
4 FLIRT (2')			
5 TAXI (2')			
6 FISH (2')			

7. PICTURE COMPLETION	
1 NOSE	9 HAND
2 MUSTACHE	10 WATER
3 EAR	11 ARM—IMAGE
4 DIAMOND	12 TIE
5 LEG	13 BASE THREAD
6 TAIL	14 EYEBROW
7 STACKS	15 SHADOW
8 KNOB	

8. BLOCKS							
CARD	T	AC.	SC.	CARD	T	AC.	SC.
1 (75")				5 (150")			
2 (75")				6 (150")			
3 (75")				7 (195")			
4 (75")							

9. OBJECT ASSEMBLY			
OBJECTS	T	PLACE	SCORE
MAN (2')			
PROFILE (3')			
HAND (3')			

FOR CALCULATING DETERIORATION (see <i>Measurement of Adult Intelligence</i> , Chapter VI)			
"HOLD" TESTS	Score	"DON'T HOLD" TESTS	Score
INFORMATION		DIGIT SPAN	
VOCABULARY		ARITHMETIC	
P.COMPLETION		BLOCK DESIGN	
OBJECT ASSEMBLY		DIGIT SYMBOL	
SUM		SUM	

% OF LOSS (Deterioration)

"HOLD" _____ - "DON'T HOLD" _____ ÷ "HOLD" _____ = _____

CORRECTION _____ % LOSS _____

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