W AIS INTRATEST AND INTERTEST SCATTER IN
DIAGNOSIS OF SCHIZOPHRENIA

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WAIS INTRATEST AND INTERTEST SCATTER IN
DIAGNOSIS OF SCHIZOPHRENIA

THESIS

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CHAPTER I

INCONSISTENT COGNITIVE FOCUSING IN SCHIZOPHRENIA

The present study deals with the application of various measures of intratest and intertest scatter to the items and subtests of the Wechsler Adult Intelligence Scale, or WAIS, in an attempt to improve the WAIS as a psychodiagnostic indicator of schizophrenia. In reviewing the literature, it will be shown that past studies on intratest and intertest scatter have been carried out with differing assessment techniques and that contradictory results have often been obtained. Up to the present time it has not been shown which assessment techniques are the most efficient as psychodiagnostic indicators of schizophrenia. The present study will analyze and criticize numerous means of assessing scatter and compare their relative efficiency as a psychodiagnostic indicator of schizophrenia, thus bringing them to bear for the first time on a single set of data. Past methods of assessing scatter, methods which have been suggested but not implemented, and original methods, will be incorporated into the present assessment. Additionally, results of factor analytic studies and normative irregularity studies on the WAIS will be incorporated into various assessment procedures. The theoretical basis of intratest and
interest scatter as a psychodiagnostic indicator of schizophrenia will be discussed in the present chapter.

Impaired cognitive focusing in the schizophrenic was early observed by Cameron (2, 3). He extracted from his early experimentation with schizophrenics the thought quality of overinclusion. This is the inability of the schizophrenic to focus his conceptualization consistently on pertinent elements of a task without including closely related, yet irrelevant elements. Considerable evidence is available in support of Cameron's theory of overinclusiveness in schizophrenic thought.

Zaslow (19) found that schizophrenics included more irrelevant stimuli in the concepts of circularity and triangularity than did normal subjects.

Epstein (6) and Moran (10) presented concept words to subjects; each concept word was followed by several alternative response words. The subjects were to choose as many response words as they thought were included in the meaning of the concept word. Both Epstein and Moran found that their schizophrenics chose a significantly larger number of response words than did normals, demonstrating that schizophrenics include in their concept formation more distantly related elements than normals.

Similarly, Lovibond (9) found that schizophrenics were more inclusive than normals in sorting objects under various given headings.
Chapman and Taylor (5) gave a number of pictures of objects to schizophrenics and had them sort the pictures under a list of concept headings. Again, schizophrenics were found to be more influenced by irrelevant elements in their conceptualizations than were normals. The sortings of the schizophrenics were severely impaired with improperly placed pictures according to trivial tangential elements of the pictures.

In a summary on his past work with various cognitive, perceptual, and motor tasks of schizophrenics, Shakow (16) concludes that schizophrenics characteristically display "inability to maintain a major set" (p. 9). By maintaining a major set, he meant maintaining a consistent state of readiness for making a response to a coming stimulus. Shakow believed that the major set is continuously in conflict with intruding minor sets from inside and outside of the person. The schizophrenic cannot adopt minor sets, indicating that his scanning process is impaired.

The idea of the schizophrenic's inability to maintain cognitive focus is further supported by Payne, Mattusek, and George's (11) theory of a filter mechanism in schizophrenic cognition. Similarly to Shakow's major set, Payne, Mattusek, and George believe that purposeful behavior is made possible by filtering out irrelevant stimuli and allowing relevant stimuli to enter into cognition, thus allowing efficient information processing in normal individuals.
They believe that the schizophrenic has a faulty filter mechanism and that extraneous stimuli intrude into cognition and disrupt proper cognitive focusing.

Weckowicz and Blewett (18) use the term "overbroad attention", which appears synonymous with Cameron's "over-inclusion", to describe the schizophrenic's cognitive processes as more global, less selective, and less analytical than that of normal individuals.

Rashkis and Singer (13) and Singer (17) describe the development of inefficient cognitive focusing. They believe that the "double bind" situation is one in which children shift their focus of attention in attempts to leave their present field and reduce anxiety. This is in order to escape their parents' communications which are so threatening, ambiguous, and contradictory that the children cannot deal with them. The children do not get a consistent and meaningful presentation of reality in which to learn to focus their attention on relevant stimuli, properly differentiate orders of stimuli, or relate their own anxiety responses to relevant external stimuli. They do not learn to perceive reality accurately. The result is a psychological disorganization characterized by inability to pay attention to and coordinate stimuli from various internal and external systems.

Chapman (4) has extended the work on inefficient cognitive focusing with tasks which can elicit errors of
overinclusion and errors of overexclusion also. He found that schizophrenics made both kinds of errors with overexclusion errors occurring most frequently on tasks requiring broad concepts as opposed to narrow ones. Seth and Beloff (15) lend support to this idea of alternation of the attention process in schizophrenia.

These are some of the studies which have led to what is known as the Interference Theory of schizophrenic thought. The interference theory has been described by Buss and Lang (1) as follows:

"This theory assumes that when a schizophrenic is faced with a task, he cannot attend properly or in a sustained fashion, maintain a set, or change the set quickly when necessary. His ongoing response tendencies suffer interference from irrelevant, external cues, and from "internal" stimuli which consist of deviant thoughts and associations. These irrelevant, distracting, mediated stimuli prevent him from maintaining a clear focus on the task at hand, and the result is psychological deficit (p. 20).

Both disorders of perception and thinking in schizophrenic patients are secondary to a disorder of the span of attention, which can be too broad or too narrow, or may alternate between the two (p. 17).

Thus, the Interference Theory is a theory of the lack of constancy of perceptual adaptation in the schizophrenic thought process. The theory describes the inability of the schizophrenic to establish adaptive cognitive focusing and maintenance of that focus for the duration of a task. Failure to maintain appropriate focus, and the intrusion of irrelevant external or internal stimuli on a previously established set, lead to inconsistent cognitive efficiency and inconsistent rate and flow of associations."
Inconsistent cognitive efficiency has long been attested to by highly inconsistent and highly variable task performance of schizophrenics. The inability to maintain the focus of attention leads to intraindividual response variability across successive steps of a task or across repeated measures of the same task.

Enhanced response variability of schizophrenics dates as far back as 1909 with Gatewood (7) who measured performance each week for thirteen weeks on four normal college students and seven hospitalized schizophrenics. His measures were taken for eleven performances such as pencil tapping, mathematical addition, card-sorting, judging length of lines, etc. He found that the performance of schizophrenics varied significantly more than that of his normals from week to week. Gatewood relates: "Thus, in conclusion, we may say that of all the disturbances of which we find evidence in these experiments the most fundamental is the loss of thought control, since this control is the very fiber of the mind" (p. 45).

In 1918, Pressey and Cole (12) referred to a frequently heard statement that "evidence of deterioration in a mentally diseased patient may be obtained by the irregularity of the results on a psychological examination" (p. 285). E. W. Scripture (14) found standard deviations of reaction-time measures to be greater in schizophrenics than in normals. Hunt (8) found schizophrenics more variable than
non-psychotics and paretics in performing tasks such as adding numbers, card-dealing, card-sorting, and substituting numbers for letters. He attributed this to inconsistent defects in government of psychological functions of the schizophrenic.


CHAPTER II

INTERTEST SCATTER

Inconsistent cognitive efficiency appears in the WAIS in terms of intertest scatter and has become a frequently used diagnostic indicator of schizophrenia. The WAIS consists of eleven subtests; intertest scatter is defined as scoring relatively low on some of the subtests of the WAIS and relatively high on other subtests. The degree and number of discrepancies between high and low subtests scores is interpreted as the subject's inability to maintain consistent focusing of attention and thought in order to score at optimal or close to optimal performance on all subtests.

The WAIS is the revised form of the Wechsler-Bellvue Intelligence Scale. More studies of scatter have been done with the Wechsler-Bellevue than with the WAIS. Much of this work has yielded inconsistent findings.

The first reported evaluation of the scatter in the Wechsler-Bellevue used in psychodiagnosics was made by Gilliland (7) in 1940. Gilliland administered the Wechsler-Bellevue to one hundred hospitalized psychotics. Intercorrelations of the subtest scores were computed and compared with subtests intercorrelation scores of Wechsler's
norms. It was found that scatter was 35 per cent greater in Gilliland's psychotic group than in Wechsler's norms.

Gilliland, Witman, and Goldman (8) administered the Wechsler-Bellevue to a control group, a schizophrenic group, a psychoneurotic group, a drug-alcoholic group, and a mentally defective group. The mean scores and sigmas on each of the tests for the groups were computed. The intertest variance, or scatter, was found to be .659 for the control group and .361 for the schizophrenic group. The intertest scatter was found to be less in the schizophrenic group than in the other groups. This is an extreme contradiction of the previous study by Gilliland (7).

Olch (12) selected a hospitalized group of thirty-two schizophrenics and divided them into two equal groups, one group of ages seventeen to twenty-nine and the other of ages thirty to forty-nine. Wechsler supplied Olch with the means and standard deviations on all subtests of the W-B scale for three hundred forty-five subjects of his master standardizing population aged seventeen to twenty-nine and three hundred forty-five subjects aged thirty to forty-nine. Olch summed the mean deviation scores for each of the two schizophrenic and normal groups to compare the overall intertest variability of their performance. The younger schizophrenics attained an average score of 9.8, the older schizophrenics 10.3, the younger normals scored 3.2, and the older normals 3.4. The results of Olch's study are further supported by Margaret (11), Wechsler (16),
and Rabin (13), all indicating a significantly higher degree of Wechsler-Bellevue intertest scatter among schizophrenics than among other groups.

Garfield (4) selected sixty-seven schizophrenic patients hospitalized in a VA hospital. For comparison with the Schizophrenics' Wechsler-Bellevue scores, he selected a control group composed of twenty-one psychoneurotics, ten psychopathic personalities, eleven chronic alcoholics, and four cases of simple adult maladjustment. The mean of sub-test scores and sigmas were computed for both the schizophrenic and non-schizophrenic group. No significant difference in scatter was found between the schizophrenics and non-schizophrenics.

It must be observed that these previously mentioned studies have assessed intertest scatter based on a mean of subtest scores for an entire group of subjects. Patterns were not analyzed separately, but the performance of whole groups was analyzed. It appears that some of the intertest scatter computed in this manner could be a result of difference in IQ level variance between the experimental and control groups rather than intraindividual intertest scatter, or variability of the subtests. If intertest scatter is computed by analyzing the manner in which subtests of an entire group are distributed around one mean of all subtests for the group, then it is possible for some of the group's subjects to have no scatter among his own eleven
subtests, yet when combined with the other subject's protocols, have the influence of increasing the subtest variability for the group because the subject's IQs are different. This is, of course, because each individual's IQ is determined by the sum of his subtest scores.

Apparently, other investigators have avoided the contamination of intertest scatter by IQ variance by computing the standard deviation of subtest scores about their own mean within their own particular WAIS protocol. Then the assessment of each WAIS's intertest scatter can be combined to attain the scatter of an entire group. This method will be called Mean Subtest Scatter. This method is also necessary in order to apply WAIS scatter to the individual patient with a psychodiagnosistic batter.

Gilhooly (5, 6) used the Mean Subtest Scatter method of assessing intertest scatter in a group of one hundred twenty-two hospitalized male war veterans. All subjects had been diagnosed as schizophrenic. He found an insignificant Pearson r of -.03 between variability of the subtests and IQ. This not only demonstrates the avoidance of mathematically contaminating intertest scatter by IQ variance, but also gives evidence that subject variables related to IQ level do not affect intertest scatter.

Rapaport says:

If one deals with differences of weighted scores, or differences of a weighted score and any kind of mean of scores, the operation of subtraction by which such differences are obtained cancels out the
intelligence level which is inherent in the scores and in the means: and the differences thus obtained are directly comparable for any two individuals, though one be dull normal and the other very superior in intelligence (14, p. 49).

Several studies affirm the diagnostic validity for schizophrenia of subtest deviations from mean subtest scores, Mean Subtest Scatter. Wechsler (17) selected 58 consecutively examined schizophrenic patients. He compared this schizophrenic group with forty-eight matched subjects from his master standardization sample. The mean of subtest deviations for the schizophrenic group was 1.98 and that for his normal group was 1.40, which are significantly different at the $p < .01$ level.

Trehub and Scherer (15) devised a scatter index based on Mean Subtest Scatter scores which is quick and easy to apply in attempting to diagnose schizophrenia. They randomly selected two hundred sixty-nine male patients in a VA hospital who had been diagnosed as schizophrenic, neurotic, or as representing a character disorder, and who had received the WAIS previously. Mean subtest scores were computed for each subject and the scores were summed disregarding sign. This sum was each subject's intertest scatter score. In a pilot study they had found that using a cutting score of nineteen, above which all cases were diagnosed schizophrenic, would yield correct diagnosis in sixty percent of the cases. They pointed out that the base rate of schizophrenic admittance into the hospital population was 61.7 percent. In their actual study the cutting
score yielded 66.9 percent correct diagnosis, which is an improvement of 5.2 percent above base rates. In a sequential analysis test they found that a cutting score of sixteen yielded correct diagnosis in 72.1 percent of the cases, an improvement of 10.4 percent above base rates.

Rapaport (14) used a similar method of computing a total mean scatter, except that he used not a mean of all the subtests around which to measure scatter, but added the variability of the subtest scores around the Verbal and Performance section means respectively, then combined the two. The Arithmetic and Digit Span subtests were omitted since Rapaport found that impairment in these two subtests was quite common in both schizophrenics and normals. His sixty-three schizophrenic subjects received significantly higher total mean scatter scores than both his fifty-nine neurotics and fifty-four normal control subjects. The Verbal section and the Performance section both independently differentiated the schizophrenics from normal and neurotic groups. It should be pointed out that a sample of psychotically depressed subjects also displayed relatively large scatter scores.

Rapaport used two additional methods of assessing intertest scatter. One method he called Modified Mean scatter, which was the difference of any verbal subtest scores except the one in question. The same process was involved in computing performance subtest scatter.
The other method, termed by Rapaport, was "scatter from the vocabulary". This is the amount that subtest scores deviate from the score on the Vocabulary subtest. This will be called Vocabulary Intertest Scatter.

These two methods of assessing intertest scatter also yielded significantly more intertest scatter for his schizophrenic population than the normal and neurotic populations except when Vocabulary Intertest Scatter was used for the performance subtests only.

Rapaport used the Vocabulary subtest score as the basis of scatter computation because he felt it to be the most stable of all subtests and that it remains relatively unimpaired by maladjustment, therefore the best indicator of intellectual level. Rapaport states: "This observation is so general as not to need specific documentation" (14, p. 52). This method of intertest scatter analysis does not seem to be the type of scatter that results from inconsistent cognitive focusing; yet, it does not contradict the Interference Theory. It may support it. If schizophrenia is characterized by inconsistent cognitive efficiency, it follows that the schizophrenic may not only present inconsistent focusing of attention, but may never attain the potential optimum level of his attention focus at all, thus present a general lowered ability to focus attention. Therefore, the total level of attention drops, not as a result of inconsistency but from general impairment
of optimum level of focusing. If scatter is assessed by the difference between subtest scores and the Vocabulary subtest score which does not drop, then the deviation of subtests represent not inconsistent levels among the subtests but a drop in all the subtest levels. It is possible for mal-adjustment to lead to a drop in IQ level without there being any substantial inconsistency among subtest levels other than the Vocabulary subtest score which remains high. Yet, the Vocabulary Intertest Scatter technique could yield a high scatter index, which is most commonly thought to measure alternation in ability to focus attention. This method of measuring intertest scatter may be a sensitive psychodiagnostic indication of schizophrenia that would not be detected by Mean Subtest Scatter, which detects alternation in the level of attention focusing.

There are a few relative factor analytic studies and normative irregularity studies which, to date, have not been incorporated into assessment techniques of intertest or intratext scatter. There has been little investigation of the factor analytic structure of the WAIS, and of these, Cohen is the most frequently cited.

Cohen (3) took a stratified sample of subjects by age, sex, geographic region, urban-rural residence, race, occupation, and education from Wechsler's master standardization group. He used 200 subjects aged 18-19, 300 aged 45-54. Additionally, he selected a representative sample
of 352 subjects aged 60-over 75 from his Kansas City area. Each group's WAIS subtests were individually factor-analyzed by the standard method of complete centroid extraction, blind oblique rotation to simple structure, and a positive manifold. Cohen found three major correlated factors. These are the same factors he found in his analysis of the Wechsler-Bellevue, using a neuro-psychiatric population (2). He also found two minor factors which he did not find in the Wechsler-Bellevue study. The three major factors are as follows: Factor A, Verbal Comprehension is vocabulary richness and verbal-symbolic manipulative ability. The WAIS subtests which loaded highly on Factor A are Information, Comprehension, Similarities, and Vocabulary, Factor B, Perceptual Organization, is the organization of non-verbal, visually perceived material against a time limit. The WAIS subtests which loaded highly on this factor are Picture Completion, Block Design, Picture Arrangement, and Object Assembly. Factor C, Memory, involves both immediate memory as well as the efficiency with which previously learned material can be called up when needed. The WAIS subtests which loaded highly on Factor C are Arithmetic and Digit Span. The Factor D, one of the two minor factors that Cohen found, loads consistently in the Picture Completion subtest for four age groups but inconsistently in the other subtests and age groups. Cohen prefers to call Factor D "untrust-worthy" or "quasi-specific". It
must simply be called a Picture Completion factor. Factor E is also inconsistent and must be called a Digit Symbol factor, which is very deficient in the 60- over 75 age group.

The above study has been further supported by Berger, Bernstein, Klein, Cohen, and Lucas (1). They administered complete WAISs to 127 male patients hospitalized in a VA hospital. All the patients had been diagnosed as schizophrenic. Additionally, 100 psychoneurotics, 100 more schizophrenics, and 100 brain-damaged subjects were collected from one of Cohen's previous studies (3). They applied objective analytical oblique rotation and statistical measures of factorial similarity to their data. They found the same three main factors as Cohen (2, 3), and one quasi-specific factor which can be interpreted as analogous with a combination of Cohen's factors D and E.

Relevant to the use of intertest scatter as a psycho-diagnostic indicator is the fact that Cohen (2, 3) and Berger, et al., (1) found that the factorial structure of the WAIS is largely invariant across groups of schizophrenics, normals, neurotics, and brain-damaged subjects. These studies also indicate that the factorial structure is largely invariant across different age levels except that in ages 18, 19, and above 60 the memory factor tends to disappear.

It would appear from these studies that to measure intertest scatter by subtest deviation from a mean of all the subtests in a WAIS, from the mean of performance subtests,
or from the mean of verbal subtests cuts across various subtests that may bear little interrelationship to each other. Inconsistent cognitive focusing should be more accurately assessed by intertest scatter when that scatter is analyzed separately within each of the three major factors. This will be called Intrafactor Intertest Scatter. If this type of scatter is not used, it is possible that an individual may have no scatter among the various subtests of each particular factor; yet, if he demonstrates that his ability for the three factors are different, it will appear that he has scattered. This will be misleading if differing factor levels are due to cultural background instead of inconsistent cognitive focusing. This means that one may assume inconsistent cognitive efficiency when the subject's cognition may be efficient, but that he just has greater ability or knowledge in one factor and lesser ability in another.

Levinson (10) may be interpreted as supporting the idea that relative performance on the three factors may result from the subject's past training, experience, and sociocultural environment rather than schizophrenic thought. Levinson selected 64 Yeshiva University students who met various criteria assuring that they were typical products of traditional Jewish values and training. These students were each administered the complete WAIS. Levinson referred to a study by Held (9) who found that Jewish
boys were superior to Gentiles in the linguistic area of
the 1938 American Council Psychological Examination and
that Gentiles were superior in the quantitative area.
Levinson hypothesized that the Jewish students would score
significantly higher on the Verbal section of the WAIS than
on the Performance section. The mean difference between
Verbal and Performance sections was 21; the critical ratio
of this difference was 10.79 which is significant at the
p < .01 level of confidence. Sixty-two of the sixty-four
student's Verbal sections were superior to their performance.
Levinson states that these students:

had been subjected, since their early school days,
to a curriculum which greatly emphasizes verbal
knowledge, rote memory, verbal concept formation,
and abstract ideas, to the general neglect of per-
formance arts. Examinations in the Talmud, for
example, are oral and emphasize the detailed memor-
ization and understanding of tracts (p. 284).

If traditionally culturalized Jews normally score much
higher on the Verbal section of the WAIS than on the Per-
formance, then we have examples of normals who show enough
intertest scatter to indicate pathology by orthodox stand-
ards, yet it is due to enculturalization of a specific type
of ability and not to inconsistent cognitive efficiency.
Although this scatter is due to difference in verbal and
performance ability, it supports the possibility also of
similar differences between the three main factors of the
WAIS without there being inconsistent cognitive efficiency.
Yet scatter among subtests within one of the three factors would still indicate inconsistent cognitive efficiency.

In summary, it can be seen that past studies of intertest scatter have yielded inconsistent results, and that there is considerable disagreement as to how intertest scatter should be quantified. Consideration of factor analytic data has been discussed in terms of its possibility of improving intertest scatter as a psychodiagnostic indicator of schizophrenia. Also, the possibility that intertest scatter may result, not from inconsistent cognitive focusing, but from a particular sociocultural-educational background, has been discussed.
CHAPTER BIBLIOGRAPHY


CHAPTER III

INTRATEST SCATTER

Another WAIS indicator of inconsistent cognitive efficiency is intratest scatter, which is similar to intertest scatter and may even be the basis of what is observed as intertest scatter. In the same way that impaired ability to focus thought and attention causes the schizophrenic to scatter his performance across the various subtests, it also causes him to scatter his performance within the various subtests. Intratest scatter is defined by a performance pattern that is inconsistent with the relative difficulty of the items within a subtest. That is, the subject misses relatively easy items and passes relatively difficult items in the same subtest. If a subject demonstrates a high degree of intratest scatter in one subtest and a low amount of intratest scatter in another subtest, this may lead to a relatively large amount of intertest scatter between the two subtests since each subtest's total score will be different due to the different amount of intratest scatter within each. Thus, in theory, it is difficult to separate intratest scatter from intertest scatter. Yet, separation is necessary for the sake of quantification.

Unlike intertest scatter assessment, intratest scatter involves the concept of relative difficulty of the test items.
Gross assessment of the intratest scatter is made possible by the fact that the WAIS test items are arranged closely to order of increasing difficulty. Wechsler (14) presents the percentage of his master standardization sample of seventeen hundred subjects who passed each item of the subtests. The Picture Completion and Object Assembly subtests are perfectly arranged in order of increasing difficulty. The Information, Comprehension, Arithmetic, Similarities, Block Design, and Picture Arrangement subtests are arranged in perfect order of increasing difficulty, with the exception of one item in each subtest. The Vocabulary subtest has eleven very slightly misplaced items. Normal and consistent cognitive efficiency then should produce two-point, one-point, and zero-point answers in approximate sequence as responses to the subtest items proceed.

The first studies of intratest scatter in intelligence tests began with the Stanford-Binet, and results were discouraging. Harris and Shakow (2), in reviewing the literature on scatter, concluded: "Research up to now has failed to demonstrate clearly any valid clinical use" (p. 148).

In a later study of various measures of scatter, Harris and Shakow (3) analyzed scatter by methods known at that time as Age-level scatter, Wallin scatter, Woodworth scatter, and Pressey scatter. Three groups of subjects received the Stanford-Binet: 50 adult schizophrenics from Worcester
State Hospital, a normal group composed of 54 employees of the same hospital, and 79 convalescent patients from a general hospital, and an adult delinquent group which consisted of 138 prisoners at Worcester County Jail. None of the four measures of scatter could adequately discriminate between these three groups of subjects.

These four methods of assessing intratest scatter can not be applied to the analysis of scatter in the WAIS because they are measures based on deviation of missed items from the mental age shown by each subtest or by the total test. However, they are significant in showing negative results using scatter, and that quantifying scatter has long been a problem. The concept of mental age is not used in scoring items on the WAIS.

The first study demonstrating the value of intratest scatter for psychodiagnostic purposes was presented by Rapaport, Gill, and Schafer (8). These investigators presented very good evidence that intratest scatter discriminates schizophrenics from normal and neurotic subjects. They divided each subject's Wechsler-Bellevue protocol into three sections, one consisting of easy items, one of intermediate items, and one of difficult items. They found that their total schizophrenic population presented a higher percentage of errors on their easy item sections of the WAIS protocols on Information, Comprehension, and Similarity subtests than did their normal population. The acute and chronic
undifferentiated schizophrenics presented a higher percentage of errors on easy items for Arithmetic, Picture Completion, and Picture Arrangement subtests than did normals. The Vocabulary subtest was significantly more scattered for schizophrenics than for normals, but not significantly more than that of neurotics.

Since Rapaport's study, little effort has been made to quantify intratest scatter, with the exception of Holzberg and Deane (4) and Watson (13).

Holzberg and Deane's study (4) exemplifies the difficulty involved in quantifying intratest scatter. Six staff psychologists at the Connecticut State Hospital were given four hypothetical subtests protocols. The psychologists were to arrange the four lists in order of the extent of intratest scatter and to explain the rationale for their ordering. There was considerable disagreement among the psychologists as to what constituted scatter. Holzberg and Deane reported that the definitions given by these six raters and other staff psychologists yielded three major subjective methods of assessing intratest scatter. One method was an estimation of the number of incorrectly answered items before the last correctly answered item. This technique will be called the Number of Misses technique. Another method of estimating scatter was by the number of changes in answering items, i.e., three consecutive incorrect answers followed by five consecutive correct answers.
would constitute one change from wrong to right. This technique will be called Number of Changes technique. It is synonymous with counting the number of runs of consecutive correctly answered items or consecutive incorrectly answered items. The third method of assessing intratest scatter took into consideration the location of change. In this method, the earlier a change to incorrect answers followed by correct answers, the more the scatter. The reason for this is that early misses are more illogical because they are further below the threshold of optimal performance for the subject. This method was approximated by Rapaport (8) in using the percentage of errors on the earliest occurring and easiest items as an index to schizophrenia. Holzberg and Deane selected the first method of assessing intratest scatter because they believed, "it seemed the simplest to express quantitatively" (p. 181). They expressed this assessment method in terms of a formula which could take into consideration partial credit answers. The scatter coefficient was calculated by first subtracting the total number of items for which any credit was given on a subtest from the number of the last item for which any credit was given and then dividing this remainder by the total raw score of the subtest. This assessment technique will be called Holzberg's Intratest Scatter Coefficient. Holzberg and Deane selected eight psychoneurotics, eight organics, and forty schizophrenics as subjects. They administered the Wechsler-
Bellevue to each subject and computed each subject's scatter coefficient for each subtest. To compare their three groups they computed means of the scatter coefficients of all subtests for each of the three groups separately, using a Fisher's \( t \) of 2.074 as significant at the five percent level. They found that intratest scatter for the Comprehension, Picture Completion, and Block Design subtests was significantly greater for schizophrenics than for neurotics. It should be observed that Holzberg and Deane did not find as many subtests which discriminate schizophrenics from other diagnostic categories as did Rapaport (8).

Watson (13) used two methods of assessing intratest scatter, "number of runs" and "proportion of correct responses", in the WAIS. Number of runs is identical with one of the three methods that Holzberg and Deane (4) found, which clinicians characteristically use in their subjective analysis of intratest scatter—Number of Changes. Watson's "proportion of correct responses", correct responses over total number of responses, approximated the method that Holzberg and Deane discovered and did use in their study, except that Watson did not take into consideration partial credit responses. Watson used Number of Changes data for all subtests except Digit Symbol. In using the "proportion of correct responses" method, Digit Symbol, Picture Completion, Picture Arrangement, and Object Assembly subtests were eliminated from the analyses since instructions do not call
for discontinuation after a set number of consecutive errors. Forty male schizophrenics were compared with forty patients with evidence of cerebral lesions. WAIS intratest scatter could not significantly discriminate the two groups.

Studies of intratest scatter, as mentioned earlier in terms of intertest scatter, have not taken into consideration relevant studies of factorial composition and normative irregularity within the subtests of the WAIS.

Fink and Shontz (1) point out that efficient performance on the WAIS should lead one to pass all the items up to a certain point of optimum level of knowledge and then miss all items from that point on. The schizophrenic is characterized by inefficient test performance. They point out that certain assumed indicators of inefficiency may be built into a test, and they attempt to show experimentally that inefficiency may be built into a test by using the WAIS Vocabulary subtest. They drew 100 systematically randomized protocols from Wechsler's original standardization group. A validation group of 100 hospitalized patients with chronic physical illnesses were used as an additional cross-check. Tables were constructed showing the frequency of occurrence of zero-point, one-point, and two-point responses for each Vocabulary item for both groups. The method of least squares was used to establish expected frequencies for each table. All deviations from expected frequencies were evaluated by the chi-square method, and a level of significance of
p < .001 (two tailed) was used as the criterion for rejecting the null hypothesis. The item words that were found to significantly deviate from expectancies were the same in both of their two groups.

Pertinent to the present experiment are those words which Fink and Shontz found to yield a higher than expected frequency of one-point responses, since this type response would be indicative of inconsistent cognitive efficiency when followed by two-point responses. These words are winter, breakfast, fabric, slice, enormous, sentence, regulate, and remorse.

Authors of conventional item analysis (5, 6, 7, 8, 10) have attributed inconsistent results in scatter to differences in the population samples used. Contrarily, Saunders states

If the items of a particular subtest really do all measure the same thing then no amount of difference in the sampling of people can bring about a significant change in the apparent order of difficulty of the items. Where such changes in the order of difficulty have been observed it is clear that the items must depend reliably on more than one dimension of performance, at least on two dimensions and possibly on as many dimensions as there are items (12, p. 367).

Saunders (11) administered complete WAISs to 288 male college and college-preparatory students. Tetrachoric correlations were applied to the scores of the Picture Completion subtests, and factor analysis was done by an iterative procedure for communality estimation. Three orthogonal factors were found. Factor I consisted of the items
lock, dog tracks, leg, arm image, shadow, and snow. Factor II consisted of the words handles, water, peg, oar lock, base thread, and Florida. Factor III consisted of the items tail, handles, water, base thread, stacks, and finger.

In a later experiment, Saunders (12), using the same protocols of the 288 male college students and college-preparatory students in his previous study, analyzed the items of the Information and Arithmetic subtests. A 43 X 43 tetrachoric intercorrelation matrix was applied and factor analysis was carried out as in his previous study. A six factor solution was reached. Factor I, General Information consists of items that are historical in content and requiring non-specific responses. Factor II, Contemporary Affairs, consists of items which require information that has not necessarily been true for a long time. Factor III, Cultural Knowledge, contains items of literary or religious content usually acquired through reading. Factor IV, Scientific Generalizations, although measured by certain appropriate Information subtest items, involves complex arithmetic problems which require a sequence of mental elementary operations in the form of a formula. Factor V, Numerical Information, involves conversion of one mathematical unit to another. Factor VI, Numerical Operations, involves manipulation of symbols according to simple rules and may be a form of ideational discipline.
Of these six factors there are five in the Information subtest and three in the Arithmetic subtest which may be potentially useful in evaluating intratest scatter in the present study. The factors and the items which load highly on them for the Information subtest are given here in their order of increasing difficulty. Factor I consists of the following items: presidents, population, Genesis, temperature, Iliad, and Koran. Factor II consists of the following items: height, Italy, Paris, Egypt, Koran. Factor III consists of the items: Vatican, Genesis, Faust, and Apocrypha. Factor IV consists of the following items: clothes, yeast, and temperature, Factor V consists of the following items: Washington, population, and senators.

In the Arithmetic subtest, Factor IV consists of the items numbered nine through twelve. Factor V consists of the items numbered 5, 6, 9, 10, 12, and 14. Factor IV consists of the items numbered 5, 8, 10, 11, and 14.

Intratest scatter occurring only within the items of these factors will be called Intrafactor Intratest Scatter.

Further reading of this study will be facilitated if the reader will give special attention to the meaning of several terms which have previously been defined. They will be summarily presented here for convenience. Mean Subtest Scatter is intertest scatter computed by summing the absolute deviation score of each subtest from the mean of the subtests. Intrafactor Intertest Scatter is Mean Subtest...
Scatter which is computed using only the subtests which make up a particular factor. Intrafactor Intratest Scatter is intratest scatter assessed only across the items which make up one of the particular factors which occur within a subtest. Vocabulary Intertest Scatter is intertest scatter computed by summing the absolute deviation of subtests from the score of the Vocabulary subtest. Number of Misses is a technique for assessing intratest scatter by counting the number of missed items which occur before the last correctly answered item. Number of Changes is a technique for assessing intratest scatter by counting the number of "runs" of consecutively correct and consecutively incorrect items. Holzberg's Intratest Scatter Coefficient is a technique for assessing intratest scatter by first subtracting the total number of items for which any credit was given on a subtest from the number of the last item for which any credit given and then dividing this remainder by the total raw score of the subtest.

In summary, the same can be said for intratest scatter as was said for intertest scatter. Studies of intratest scatter have yielded inconsistent results and different techniques have been used to quantify this scatter. The possibility of improving intratest scatter as a psychodiagnostic indicator of schizophrenia by incorporating results of factor analytic studies and normative irregularity studies into assessment techniques has been discussed.
CHAPTER BIBLIOGRAPHY


CHAPTER IV

VARIABLES AND HYPOTHESES

Each variable consisted of a different aspect or different method of assessing intratest or intertest scatter. Each variable represented an attempt to find the most efficient psychodiagnostic indicator of schizophrenia.

Variable 1 was intertest scatter computed for each individual WAIS by finding the sum of the absolute deviation of each of the eleven subtests from the mean of all eleven subtests. Each subtest deviation score represented that subtest's intertest scatter about the mean of the eleven subtests.

In a similar manner to that above, Variable 2 was computed using only the intertest scatter of Verbal subtests about the mean of only the Verbal subtests. Similarly, Variable 3 involved scatter of the Performance subtests about the mean of Performance subtests.

Variable 4 was intertest scatter computed for all the subtests by summing the Verbal subtests' scatter about the Verbal mean with the Performance subtests' scatter about the Performance mean.

Three of the above Variables, Variable 1, Variable 2, and Variable 4, were again computed but with the Arithmetic
and Digit Span omitted. These were then Variable 5, Variable 6, and Variable 7, respectively.

For each WAIS, the IQ score of the Verbal section was subtracted from the IQ score of the Performance section. This was Variable 8.

Additionally, intertest scatter was computed for each WAIS by tabulating each of the subtest's absolute deviation, not from a mean, but from the Vocabulary subtest score of that WAIS. This was Variable 9, one of the variables previously named as Vocabulary Intertest Scatter. Computed in a manner identical to that of Variable 9, was Variable 10 which involved only the Verbal subtests' scatter about the Vocabulary subtest score. This is Vocabulary Intertest Scatter among the Verbal subtests.

Variable 11 and Variable 12, respectively were analogous with Variable 9 and Variable 10, but with the Arithmetic and Digit Span subtests omitted from computations.

Additionally, Vocabulary Intertest Scatter was calculated for the subtests of the Verbal section, but including in the calculation only those subtests which scattered negatively, or dropped below, the level of the Vocabulary subtest. This meant eliminating those subtests that were elevated above that of the Vocabulary subtest. This was Variable 13.

For each WAIS protocol, a mean score of the subtests composing Factor A was computed, a mean of those composing
Factor B, and a mean of those composing Factor C. Each subtest's absolute deviation, intertest scatter, from the mean of the subtests in its respective factor was computed. This was Intrafactor Intertest Scatter. Variable 14 was Intrafactor Intertest Scatter among the subtests of Factor A; Variable 15 was Intrafactor Intertest Scatter among the subtests of Factor B; Variable 16 was Intrafactor Intertest Scatter among the subtests of Factor C. Variable 17 was the summation of Variables, 14, 15, and 16.

Intratest scatter, assessed by the Number of Misses technique for each subtest except Digit Span and Digit Symbol, was summed for each WAIS to yield Variable 18. This was repeated, but using the Number of Changes technique of assessing intratest scatter, to yield Variable 19. This was again repeated, but using Holzberg's Scatter Coefficient method of assessing intratest scatter, to yield Variable 20.

Intratest scatter, assessed by the Number of Misses technique for each of the Verbal subtests except Digit Span, was summed for each WAIS to yield Variable 21. This was repeated, but using the Number of Changes technique of assessing intratest scatter, to yield Variable 22. This was again repeated, but using Holzberg's Scatter Coefficient method of assessing intratest scatter, to yield Variable 23.
Intratest scatter, assessed by the Number of Misses technique for each of the Performance subtests except Digit Symbol, was summed for each WAIS to yield Variable 24. This was repeated, but using the Number of Changes technique of assessing intratest scatter, to yield Variable 25. This again was repeated, but using Holzberg's Intratest Scatter Coefficient for assessing intratest scatter, to yield Variable 26.

Factor analytic data and normative irregularity data were incorporated into assessment techniques of intratest scatter. The Number of Misses was used to assess intratest scatter on the items within intrasubtest factors of the Information, Arithmetic, and Picture Completion subtests. This was Intrafactor Intratest Scatter. This was performed by taking the items in each separate factor and counting each missed item which occurred before the last correctly answered item of that factor, ignoring all correctly or incorrectly answered items which did not compose the particular factor. Intrafactor Intratest Scatter was scored by the Number of Misses technique in the Information subtest to yield Variable 27. The same was assessed in the Arithmetic subtest to yield Variable 28. The same was assessed in the Picture Completion subtest to yield Variable 29.

Intratest scatter in the Vocabulary subtest was assessed by the Number of Misses technique, omitting the misplaced items which tend to yield a higher than expected frequency of one-point responses. This was Variable 30.
Variable 31 was the summation of Variables 27, 28, 29, and 30.

Assessing intratest scatter only within intrasubtest factors, Intrafactor Intratest Scatter, does not take into consideration all of the incorrect responses occurring on items outside of the various intrasubtest factors. In an attempt to partially correct for this, the method of counting One & Two Points was designed. In this method, incorrect responses occurring outside of factors were assigned 1 point scatter credit and those occurring within the factors were assigned 2 points scatter credit. Intrafactor Intratest Scatter using One & Two Points for the Information subtest was Variable 32. Intrafactor Intratest Scatter using One & Two Points for the Arithmetic subtest was Variable 33. Intrafactor Intratest Scatter using One & Two Points for the Picture Completion subtest was Variable 34.

Variable 25 was the summation of Variables 30, 32, 33, and 34.

Additionally, intratest scatter assessed by the Number of Misses technique for each of the subtests, omitting Digit Span and Digit Symbol, was taken as a separate variable. That for the Information subtest was Variable 36; that for the Comprehension subtest was Variable 37; that for the Arithmetic subtest was Variable 38; that for Similarities subtest was Variable 39; that for the Vocabulary subtest...
was Variable 40; that for the Picture Completion subtest was Variable 43; and that for the Object Assembly subtest was Variable 44.

The following hypotheses were made.

**Hypothesis I**: Intertest scatter on the WAIS will significantly discriminate the schizophrenic group from the college student group.

**Hypothesis II**: Intertest scatter scores for the Verbal section and the Performance section taken separately, and then combined, will differentiate the schizophrenic group from the college student group at a more significant level than intertest scatter computed for the entire WAIS together.

**Hypothesis III**: The difference between Verbal IQ and Performance IQ will discriminate the schizophrenic group from the college group at a significant level.

**Hypothesis IV**: Vocabulary Intertest Scatter will discriminate the schizophrenic group from the college student group at a significant level.

**Hypothesis V**: Variable 13 will differentiate the schizophrenic group from the college student group and do this at a more significant level than any of Variable 9, 10, 11, and 12.

**Hypothesis VI**: Intrafactor Intertest Scatter will differentiate the schizophrenic group from the college student group at a significant level.
Hypothesis VII: Intrafactor Intertest Scatter will differentiate the schizophrenic group from the college student group at a higher level of significance than Mean Subtest Scatter, which does not take known factors into consideration.

Hypothesis VIII: Omitting the Arithmetic and Digit Span subtests will improve the ability of intertest scatter to differentiate the schizophrenic group from the college student group.

Hypothesis IX: Intratest scatter will significantly differentiate Group Y from Group X.

Hypothesis X: Holzberg's Intratest Scatter Coefficient will differentiate the schizophrenic group from the college student group at a higher level of significance than the Number of Misses technique; and the Number of Misses technique will differentiate the two groups at a higher level of significance than the Number of Changes technique.

Hypothesis XI: Intrafactor Intratest Scatter will differentiate the schizophrenic group from the college student group at a higher level of significance than intratest scatter techniques that do not take into consideration the intrasubtest factors.

Hypothesis XII: The One & Two Point technique will enable Intrafactor Intratest Scatter to differentiate the schizophrenic group from the college student group at a higher level of significance than does Intrafactor Intratest Scatter assessed by the Number of Misses technique.
Hypothesis XIII: Intratest scatter of each of the WAIS subtests will, taken individually, discriminate the schizophrenic group from the college student group at a significant level.
CHAPTER V

METHODOLOGY AND RESULTS

Subjects

Group Y, the experimental group, consisted of WAIS protocols of 36 patients taken from the patient files of the Fort Worth Neuropsychiatric Center & Hospital. All protocols were of patients who had received a psychiatric diagnoses of schizophrenia. To randomize as much as was possible the differences in psychiatric judgement of schizophrenia, twelve patients were taken from the files of each of three different psychiatrists.

The WAIS protocols of schizophrenics with additional organic complications were not used. Extreme scores and the possibility of mental retardation was eliminated by using no protocols with IQ scores below 80 or above 130 for both the experimental and the control group. To control for early senescence, no patient above the age of 55 was used. Unfortunately, N had to be limited to schizophrenic patients who had received the WAIS in full. To many schizophrenic patients, only the Verbal section of the WAIS had been administered.

All WAISs had been administered by staff psychologists or interns who had received graduate training in the administration of the WAIS.
The mean age of the schizophrenic group was 29.83 and the mean IQ was 103.22. The group consisted of nineteen female subject protocols and fourteen male subject protocols.

At this point, a selective process involved in the collection of schizophrenic patients' WAISs must be pointed out. At the clinic from which the present protocols came, many of the severely schizophrenic patients are referred to long term clinics before they are tested. In many instances, the patients who are most obviously schizophrenic are not administered the WAIS, for it is not needed for differential diagnosis. Also, at times, administration of the WAIS is begun, but discontinued because the patient becomes too emotionally upset to continue, or because the initial results indicate schizophrenia immediately. The schizophrenic WAISs of this study are most likely to be those of patients with milder degrees of schizophrenic disturbances, patients for which the WAIS was needed for differential diagnoses of what at first appeared to be a borderline case.

Group X, the control group, consisted of WAIS protocols of 36 nonhospitalized college students. Eleven WAISs were administered by the author to volunteers at North Texas State University. Nine protocols of North Texas State University students were taken from a student who had administered them as part of a graduate training program in testing. Sixteen WAIS protocols were taken from the control group of an experimental study performed by a North Texas
State University graduate student using students of Texas Woman's University. Only protocols of sophomores, juniors, seniors, and graduate students who possessed at least an overall grade average of C were used. Freshmen, regardless of their grade average, and poor students were not included. This was done to help in decreasing the probability of obtaining schizophrenics who might demonstrate inconsistent cognitive focusing in the control group.

The mean age of the college student group was 23.45 and the mean IQ was 115. The group consisted of 24 female subjects' WAIS protocols and 12 male subjects' WAIS protocols.

Design

Each variable was singly summed across all WAIS protocols. Means and standard deviations were computed for each of the forty-four variables. This was done separately for Group X and for Group Y. A t-test was performed for the differences between the means of Group X and Group Y for each of the forty-four separate variables. A t value of 2.04 was used for rejecting the null hypothesis at the p < .05 level of significance, 2.75 at the p < .01 level of significance, and 3.64 at the p < .001 level of significance. A significant positive t score indicated that the hospitalized schizophrenic group scattered significantly more than the nonhospitalized college student group on that particular variable.
Results

Table I gives the means, standard deviations, and t-scores for each of the forty-four variables. Five variables were significant at the p < .001 level; seven variables were significant at the p < .01 level; and three variables were significant at the p < .05 level.

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CHAPTER VI

DISCUSSION

Discussion of Results

Variable 1 most closely resembles the more orthodox methods of intertest scatter assessment, scatter of all subtests about the mean of subtests. This variable failed to differentiate Group Y from Group X. As was shown earlier, many contradictory results have been reported in the literature with this Mean Subtest Scatter. The present study casts great doubt on the usefulness of this technique as a psychodiagnostic indicator of schizophrenia. It was observed that the means and standard deviations of Group X and Group Y were quite similar in Variables 1, 2, 3, and 4, showing that Group X and Group Y perform quite similarly on this type of scatter and related variables. Hypothesis I was not supported. Intertest scatter measured by Mean Subtest Scatter, did not differentiate the hospitalized schizophrenics from the nonhospitalized college students at a significant level.

This supports the idea that different scores on the WAIS subtests may not indicate the inconsistent cognitive focusing of a schizophrenic, but only that the subject's ability for the various subtests differ. This may be due
to sociocultural backgrounds and the subject's particular type of education. This was discussed earlier in terms of Levinson's (2) study.

Likewise, Variables 14, 15, 16, and 17, which measure Intrafactor Intertest Scatter, did not discriminate Group Y from Group X. Although the t scores of these variables were not significant, they were substantially higher than those of Mean Subtest Scatter. Thus, taking into consideration factors consisting of various subtests, somewhat improves the present ability of WAIS intertest scatter to discriminate the schizophrenics from the college students.

Hypothesis VI was not confirmed. Intrafactor Intertest Scatter did not discriminate Group Y from Group X at a significant level. Although no measures of intertest scatter significantly discriminated Group Y from Group X, Hypothesis VII was confirmed. Considering factors, made up of various subtests, did substantially raise the value of t scores for discriminating between the means of Group Y and Group X.

By observing t scores of Variables 9, 10, 11, and 12, it was observed that Vocabulary Intertest Scatter, scatter of the subtests about the Vocabulary subtest score, is a slightly better diagnostic indicator of schizophrenia than Mean Subtest Scatter. However, Vocabulary Intertest Scatter did not differentiate Group Y from Group X at a significant level. Therefore, Hypothesis IV was not confirmed.
This provides a clue as to why intertest scatter, in general, did not discriminate Group X from Group Y; and why past studies of intertest scatter have yielded contradictory results. It may be that inconsistent cognitive efficiency of the schizophrenic does lead to drops in the levels of various subtests; but if all subtests drop to an even extent, then little intertest scatter can be assessed by any technique which takes the subtests' deviation from the mean of subtests. This is because the mean would drop down to a lower level with the subtests. This could be the reason that Vocabulary Intertest Scatter yielded higher t scores for the difference between Group Y and Group X than did Mean Subtest Scatter, and that neither type of scatter yielded significant t scores. For further research, there needs to be a technique devised which will sensitively assess intertest scatter whether a few of a WAIS's subtests drop or whether most all of them drop to an even extent. Perhaps one could use both techniques of Mean Subtest Scatter and Vocabulary Intertest Scatter, using the one which yielded the greatest amount of scatter on each particular WAIS.

Variable 13, Vocabulary Intertest Scatter using only subtests whose scores are below that of the Vocabulary subtest, did not differentiate Group Y from Group X at a significant level. Neither did it differentiate Group Y from Group X at a higher level of significance than all
of Variables 9, 10, 11, and 12. Therefore, Hypothesis V was disconfirmed.

Variable 7 yielded a slightly higher \( t \) score than Variable 4, both measures of Mean Subtest Scatter. Variables 11 and 12 yielded considerably higher \( t \) scores than Variables 9 and 10, all being measures of Vocabulary Intertest Scatter. Hypothesis VII, in general, at least for Vocabulary Intertest Scatter, is considered confirmed. The omission of Arithmetic and Digit Span subtests from assessment of intertest scatter does appear to increase the ability of intertest scatter to discriminate Group Y from Group X. Thus, these two subtests are frequently lowered in both schizophrenics and nonschizophrenics.

Variable 4 did yield a considerably higher \( t \) score than Variable 1. Variable 7 also yielded a considerably higher \( t \) score than Variable 5. Therefore, Hypothesis II is confirmed. Intertest scatter scores for the Verbal section and the Performance section taken separately and then combined, differentiates Group Y from Group X better than computing intertest scatter for all the subtests at once. This supports the idea that the Verbal section and the Performance sections are not interrelated sections. Assessing scatter about a point or a mean in the Verbal section and then about a mean in the Performance section does not cut across the two sections and yields better
results than assessing scatter about one mean, which cuts across the Verbal section and the Performance section. If these are independent sections, then the difference between them should not account for any of the scatter.

Hypothesis III was unconfirmed. The hospitalized schizophrenics' Verbal IQs were not elevated significantly more above their Performance IQs as compared to the nonhospitalized college students. In fact, Variable 8 yielded a negative t score, indication quite the opposite.

The t scores of nine Variables, 18 through 26, were all significant. Five of the variables were significant at the p < .001 level; three of the variables were significant at the p < .01 level; and one variable was significant at the p < .05 level. This gives strong evidence that intratest scatter is a significant psychodiagnostic indicator of schizophrenia. Hypothesis IX is confirmed.

By observing the t scores of Variables 18, 21, and 24 for the Number of Misses technique, Variables 19, 22, and 25 for the Number of Changes technique, and Variables 20, 23, and 26 for Holzberg's Intratest Scatter Coefficient, one gets an estimation of the relative value of these three techniques for discriminating Group Y from Group X. Hypothesis X was confirmed. Holzberg's Intratest Scatter Coefficient appears superior to the Number of Misses technique, which appears superior to the Number of Changes technique, for discriminating Group Y from Group
X. All three techniques of assessing intratest scatter yielded significant variables.

Holzberg's Intratest Scatter Coefficient appeared only slightly superior to the Number of Misses technique, so slight as not to warrant the time involved in its use. Holzberg's Intratest Scatter Coefficient involves the application of a mathematical formula to each subtest of the WAIS. It is suggested that the Number of Misses technique is a more practical technique for assessing intratest scatter for possible diagnosis of schizophrenia.

The Number of Changes technique appears considerably more inferior to the other two techniques. This is easily understandable since this technique, in effect, measures the number of runs of consecutively correct or consecutively incorrect responses. Thus, it does not consider the number of items missed in a particular "run"; i.e. three wrong answers, if they occur together, are no worse than one wrong answer. Still, it must be kept in mind that this technique yielded Variables with significant t scores of 3.60, 3.06, and 2.61. This was because runs of consecutively incorrect responses did not frequently occur. One missed item is still counted as a run, therefore the Number of Changes technique is often reduced to the same thing as the Number of Misses technique.

Further research should attempt to devise an intratest scatter cutting score for differential diagnosis of schizophrenia. The mean intratest scatter score, measured by the
Number of Misses technique, was 22.64 for the schizophrenic group and 14.44 for the college student group. The standard deviations of the two groups were 6.05 and 7.54. This can be found in Table I on Variable 18. The critical point or cutting score would appear to be around 18. It will be recalled that Trehub and Scherer (3) did this for intertest scatter.

Computation of point biserial correlation coefficients yielded .42 for Variable 18, -55 for Variable 20, and -41 for Variable 23. This suggests the future possibility of experimentally devising a regression equation predicting the degree of schizophrenic disturbance from the degree of intratest scatter.

The t scores of Variables 36 through 44 inclusive, show that Hypothesis XIII is not confirmed. Not all of the subtests, taken individually, yielded intratest scatter which could discriminate Group Y from Group X. However, the Information, Comprehension, and Picture Completion subtests each individually discriminated Group Y from Group X at the p < .01 level of significance. The Block Design subtest individually discriminated between the two groups at the p < .05 level. However, it was felt that the Block Design subtest, taken alone, has little practical value as a psychodiagnostic indicator of schizophrenia since the mean scatter for this subtest is less than 1 in both Group X and Group Y. These results are similar to that of Holzberg and
Deane (1), who found that intratest scatter of the Comprehension, Picture Completion, and Block Design subtests significantly discriminated schizophrenics from neurotics.

Hypothesis XI was not confirmed. The $t$ scores of Variables 27, 28, 29, 30, and 31 were not significant, nor were they larger than the $t$ scores of Variables 18 through 26. Thus, Intrafactor Intratest Scatter, assessed by the Number of Misses technique, did not discriminate Group Y from Group X.

Hypothesis XII was confirmed. The One and Two Points technique of assessing intratest scatter greatly improved the ability of Intrafactor Intratest Scatter to discriminate between Group X and Group Y. This is shown by Variable 32, 33, 34, and 35. Although Variable 35 yielded a $t$ score of 3.28, which is significant at the $p < .01$ level, Variable 18 yielded a $t$ score of 5.01. Thus, for psychodiagnosis of schizophrenia, taking intrasubtest factors into consideration does not improve the value of intratest scatter above that of intratest scatter which does not consider factors.

The Picture Completion subtest seems to be particularly valid as a psychodiagnostic indicator of schizophrenia. It was among the only three subtests yielding intratest scatter, taken individually, which discriminated Group Y from Group X at the $p < .01$ level of significance. It yielded a $t$ score of 3.01. It also yielded the highest $t$ score, a $t$ of
1.88, of the four subtests used in assessing Intrafactor Intratest Scatter, by the Number of Misses technique. It yielded the only significant \( t \) score, a \( t \) of 2.67, of the four subtests used in assessing Intrafactor Intratest Scatter by the One and Two Point technique. As mentioned previously, the Picture Completion subtest was among the three subtests which differentiated schizophrenics from normals in Holzberg and Deane's study (1). It would be interesting for further research, to see to what extent this subtest, taken alone, could discriminate schizophrenics from various other groups. This subtest is among the simplest and most objectively scored subtests in administration of the WAIS; i.e. the subject simply has 20 seconds in which to name the missing part in each of a series of pictures. There is no partial credit involved.

Conclusions

1. The various forms of intertest scatter are not significant psychodiagnostic indicators of schizophrenia. However, they are slightly improved by omitting the Arithmetic and Digit Span subtests, and by assessing scatter within the Performance section and Verbal section instead of across them, or within the various known subtest factors instead of across them.

2. Subtests scatter about the Vocabulary score is a slightly more efficient psychodiagnostic indicator of
schizophrenia than subtest scatter about a mean of subtests, although neither scatter is significant.

3. The difference between the Verbal IQ and Performance IQ is very nonsignificant as a psychodiagnostic indicator of schizophrenia.

4. Intratest scatter is a highly significant psychodiagnostic indicator of schizophrenia, especially intratest scatter of the Information, Comprehension, Picture Completion, and Block Design subtests, which each individually discriminated hospitalized schizophrenics from nonhospitalized college students. Intratest scatter is not improved by scoring scatter within intrasubtest factors instead of across them.

5. Holzberg's Intratest Scatter technique is slightly superior to the Number of Misses technique, which is considerably superior to the Number of Changes technique for assessing intratest scatter. For practical purposes, it is recommended that Number of Misses technique, simply counting the number of incorrectly answered items before the last correctly answered item, be used as the psychodiagnostic assessment technique of intratest scatter.
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CHAPTER VII

SUMMARY

The present study dealt with the application of various measures of intratest and intertest scatter to the items and subtests of the Wechsler Adult Intelligence Scale, in an attempt to improve it as a psychodiagnostic indicator of schizophrenia.

In Chapter I, through review of the literature, the high response variability of the schizophrenic was established, and this variability was explained as resulting from inconsistent cognitive focusing, as described by the Interference Theory of schizophrenic thought. This theory assumes that when the schizophrenic is faced with a task, he cannot maintain a consistent level of cognitive focusing. His ongoing response tendencies suffer interference from irrelevant external cues, and internal deviant thoughts and associations, all of which are basic to the span of attention which can fluctuate from too broad to too narrow.

Chapter II treated the manifestation of the schizophrenic's inconsistent cognitive focusing in terms of intertest scatter on the WAIS. The same was treated in Chapter III for intratest scatter. These two chapters show that past studies of intertest and intratest scatter have yielded contradictory results, and that there is considerable
disagreement as to how this scatter should be quantified. The various techniques of quantification were analyzed and discussed. Factor analytic and normative irregularity data were discussed in terms of their possibly improving scatter as a psychodiagnostic indicator of schizophrenia. The possibility that intertest scatter may result, not from inconsistent cognitive focusing, but from particular sociocultural educational background, was discussed.

Group Y consisted of WAIS protocols of 36 patients taken from the patient files of the Fort Worth Neuropsychiatric Center and Hospital. All protocols were of patients who had received a psychiatric diagnoses of schizophrenia. Group X consisted of WAIS protocols of 36 nonhospitalized college students of North Texas State University.

In Chapter IV forty-four variables of intratest and intertest scatter were formulated, derived from previously used techniques of assessing scatter, original techniques, and modifications of past techniques. Relevant factor analytic data was incorporated into some techniques by scoring scatter only within factors instead of cutting across various factors. Variables were constructed so that assessment techniques were applied separately to the WAIS Verbal section, the Performance section, the individual subtests, and items.
It was hypothesized that intratest and intertest scatter would discriminate Group Y from Group X. Hypotheses were made as to which variables, representing different assessment techniques, would discriminate Group Y from Group X at the highest levels of significance. It was hypothesized that various techniques which take into consideration reported factors and normative data would improve the ability of scatter as a psychodiagnostic indicator of schizophrenia.

The difference between the means of Group Y and Group X for each of the forty-four variables was tested by use of t-tests. The t scores indicated that five variables were significant at the \( p < .001 \) level; that seven variables were significant at the \( p < .01 \) level; and that three variables were significant at the \( p < .05 \) level.

Intratest scatter was found to be a useful psychodiagnostic indicator of schizophrenia, and it was recommended that this scatter be assessed simply by counting the number of missed items which occur before the last correctly answered item on a WAIS. Intertest scatter did not significantly discriminate between Group Y and Group X; however, several techniques were found to improve this scatter as a psychodiagnostic indicator. In general, taking into consideration factors composed of subtests, and intrasubtest factors, did not improve the value of intratest or intertest scatter as a psychodiagnostic indicator of schizophrenia. The difference between WAIS Verbal IQ and Performance IQ did not discriminate Group Y from Group X.
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