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The validation of a short form test of adult intelligence

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THE VALIDATION OF A SHORT FORM TEST OF ADULT INTELLIGENCE

BY

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PREFACE

This thesis deals with the validation of a short form of the Wechsler-Bellevue Intelligence Scale. The data used for this validation were obtained from the Psychology Clinic of the Medical College of Virginia, The State Mental Hygiene Clinic, and the files of the Psychology Department of the University of Richmond.

The test is designed to fill the need for a short form individual test of adult intelligence. A test of this type is often needed in clinical and institutional work, or wherever a quick measurement of intellectual capacity is required. Such a test must conform to certain criteria; it must have something more to commend it than that of indicating the individual's ceiling of ability, otherwise any of the group tests might be more suitable. The particular short form test under consideration must not only have the virtues of an individual test but those of a diagnostic test as well. For this reason, three sub-tests of the Wechsler-Bellevue Scale were chosen to make up the short form. The sub-tests

used by Wechsler are recognized as valid measures of intelligence with both quanitative and qualitative significance.

The author is deeply indebted to Mr. Austin Grigg, psychologist for the State Mental Hygiene Program, for his assistance and encouragement in carrying out this project.

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I

INTRODUCTION

In clinical situations where the psychologist is required to examine large numbers of individuals and to administer many different types of tests, one hour is too much time to spend in estimating the general intelligence level. There is a great need for a short form test that will provide a reliable measure of the intelligence, and still possess sufficient diagnostic value to screen those patients who should be given the full scale.[1]

The criteria that must be met by the short form test are:

1. Estimate as accurately as possible the results which would be obtained on the full scale.

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1. Geil, George A., "A Clinically Useful Abbreviated Wechsler-Bellevue Scale", The Journal of General Psychology, the Journal Press, Provincetown, Mass., Vol. 20, First Half, July 1945, p. 101.

2. Detect clinical impairment, leading to decision to administer entire test for diagnostic purposes.

3. Require a minimum time for administration.

4. Require a minimum amount of materials.[2]

"If a short test is to be economical of time in cases where a longer test must later be administered, it would appear that the short test should be a part of the longer test. A test adaptable to such use is the Wechsler-Bellevue Scale."[3]

There are certain potential dangers in any short form test. The use of an abbreviated form may encourage snap judgments based on insufficient evidence. The items selected may not be statistically valid or reveal reliable differences. There is also the possibility a clinician might form the habit of giving the short form too often when the longer form would reveal more information about the patient. In general, over reliance on short form tests in the clinical practice should be avoided; the longer form should be used whenever possible in order that the various aspects of behavior functioning may be sampled as completely as possible.[4] It is important

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2 Patterson, C. H., "A Comparison of Various 'Short Forms' of the Wechsler-Bellevue Scale", Journal of Consulting Psychology, Science Printing Co., Lancaster, Pa., Vol. X, No. 5, Sept.-Oct. 1946, p. 261.

3 Ibid.

4 Op. Cit., pp. 260-261.

to remind ourselves again that when abbreviated intelligence tests are used they must serve as dagnostic indicators and quick measures of intellectual level.[5]

The short form test presented in this paper is composed of three sub-tests of the Wechsler-Bellevue Scale: (1) Comprehension, (2) Similarities, (3) Block Design. To the best of my knowledge, no study of this combination of tests has been reported in the literature. This combination of tests was selected after a careful statistical analysis of all the sub-tests making up the total Wechsler Scale.

In describing and appraising the Comprehension sub-test, Wechsler states that it is one of the most popular types of tests with examiners and that it has significant clinical value. It is used primarily for its value in diagnosing psychopathic personalities, suggesting possible schizophrenic trends, and in determining something of the social and cultural backgrounds of the subjects. It is essentially a test of common sense, involving a certain amount of practical information plus ability to evaluate past experience. The twelve questions included in Comprehension are simply worded to avoid mininterpretation, and there is practically no improvement

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5 Hunt, W. A., French, Elizabeth G., Klebanoff, S. G., Mensh, I. N., and Williams, M., "Clinical Possibilities of an Abbreviated Individual Test," Journal of Consulting Psychology, Science Printing Co., Lancaster, Pa., Vol. XII, No. 3, May-June 1948, p 171.

in the answers after periods of practice. It is not especially good for use with children or very poor verbalizers. This test correlates .68 (ages 35-49) with the full scale, and it holds up well with age.[6]

In regard to the Similarities test, Wechsler says that it is one of the best tests in the entire battery. The words used are simple in order to overcome the language factor; it is easy to give and is of interest to most adults. Its chief value is the qualitative nature of its weighted scoring; different point values are given for answers according to their increasing superiority. It thus distinguishes between mature and immature levels of thinking. It correlates .73 with the full scale, a correlation which is bettered only by the Vocabulary test.[7]

The Block Design test has a considerable history. Wechsler credits the original author of the test, Kohs, and notes its early use as a comprehensive measure of non-verbal intelligence. The test as used by Kohs has been modified for suitable use as a sub-test but keeps its basic clinical value. It is the best test of the performance scale, indicating the general level of intelligence and offering data for qualitative analysis. It measures much the same type of ability that the

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6 Wechsler, David, The Measurement of Adult Intelligence, The Williams and Wilkins Co., Baltimore, Md., Third Edition, 1944, pp. 80-81.

7 Op. Cit., pp. 85-87.

verbal tests do, yet the way in which it is attacked is often indicative of the subject's personality and temperament. Its greatest value is its diagnostic ability. Mental deficients do very poorly on it, seniles and most cases of brain disease have great difficulty even with the simplest designs - they seem to have lost their synthesizing ability or abstract approach, and those who are able to break the designs up into parts do best on it. It ties with Similarities for the second highest correlation of all the subtests with a correlation of .73 with the total scale.[8]

The three sub-tests selected to make up the short form, Comprehension, Similarities, and Block Design, are the three tests on the Wechsler Scale that are least affected by education, opportunity, and environment. They minimize the use of language and tend to reveal the true intellectual level of the individual. The Block Design is the only one that requires the use of extra equipment - a stop watch, a set of blocks, and a set of designs. The scoring of the three tests is simple; the administration is easy; and the directions are easily comprehended by the subject. The time for administering and scoring the short form requires about twenty percent of the time allotted for the full scale, and the score derived gives a reliable prediction of the intelligence level.

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8 Op. Cit., pp. 91-94.

II

HISTORY

The study of short form intelligence tests is in its infancy. The need for quick evaluations of intelligence in an individual form is a direct result of World War II when the Armed Forces needed to appraise quickly the abilities and intellectual makeup of millions of men and women.[1] The earliest study of a short form Wechsler test reported in the literature was by Albert Rabin, who published his results in 1943.

The short form introduced by Rabin was an outgrowth of clinical and empirical data acquired over a period of years spent in working with the Wechsler-Bellevue Scale; it was the result of factor analysis or arm chair philosophy. In selecting the subtests to be used in the short form, he chose those that apparently correlated with general mental level, were

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1 Patterson, C. H., "A Comparison of Various 'Short Forms' of the Wechsler-Bellvue Scale", Op. Cit., p 260.

easy to administer, and required a minimum of materials. He selected three verbal sub-tests: Comprehension, Similarities, and Arithmetic. He examined and correlated the data of two different groups. One of his groups was composed of 92 female student nurses with an age range of 19-25 years, and an IQ range of 85-130. The other group was made up of 200 hospital patients, most of whom were either psychotic or neurotic. 128 were males and 72 were females. The age range was 15-36 years, and the IQ range was 39-122.[2]

Using the formula $X = \frac{C.A.S.}{3} \times 10$, where C. A. S. is the sum of the weighted scores of the three sub-tests used in the short form, Rabin found a correlation of .80 between the short form and the full scale Wechsler on the group of nurses. All of the correlations were in terms of weighted scores not IQ's. On this same group the correlation of the short form with the verbal scale of the Wechsler was .88, and the correlation with the performance scale was .51. By using all verbal tests on the short form, the correlation with the performance scale was very low. He found a correlation of .956 between the short form and the total Wechsler on the group of patients. The correlation between the short form and the verbal scale for this

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2 Rabin, A. I., "A Short Form of the Wechsler-Bellevue Test", Journal of Applied Psychology, Northwestern University, Evanston, Ill., Vol. 27, No. 4, Aug. 1943, pp. 320-321.

group was .952, and for the performance scale was .759.[3]

The correlation between the Stanford Binet (L) and the full scale Wechsler is .93 as given by Benton; Wechsler gave .82 as the correlation between the two tests. Rabin feels that his short form correlations are very significant as they are as high as the correlation between the Wechsler and another intelligence test. Furthermore, the test and retest correlation of the Wechsler is given by its author as .94, and Rabin's correlations are as high as that on the abnormal patients.[4]

Rabin noted several limitations in his short form test. It is a verbal test, hence it is not applicable to those with a language handicap. The population showing the high degree of correlation is largely a selected sample. The short test necessarily limits the range of the examinee's expression and the examiner's observation.[5]

In support of the test, Rabin cited several advantages of his short form. Among the advantages he claims for it is its times saving feature, requiring only 25% of the total time for administration and scoring. Moreover, it takes the subject's age into account by translating the weighted scores into IQ's, similar to the procedure for the full scale. The short

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3 Op. Cit., pp. 321-323.
4 Ibid.
5 Op. Cit., pp. 323-324.

form also reveals a high correlation with the full scale, which indicates accurate prediction of the intellectual level.[6]

In 1945, George Geil published a four form abbreviated Wechsler Scale for clinical use, consisting of Comprehension, Similarities, Digit Span, and Block Design. Geil chose Comprehension and Similarities because they are especially valuable for detecting patients with early schizophrenic thought disturbances, and he felt that Block Design revealed the examinee's manner of dealing with a new problematical situation and also showed his reactions when frustrated by failure. Geils' short form requires 25 minutes for administration, and it correlates .966 $\pm$ .033 with the full scale, using IQ's instead of weighted scores. He found that 95% of the 250 cases used deviated 0 to $\pm$ 10 IQ points between the short form and the full scale Wechsler.[7]

Hunt, French, Klebanoff, Mensh, and Williams designed an abbreviated scale for clinical use composed of Comprehension and Similarities, taken from the Wechsler Scale, and a Vocabulary test of 15 words adopted from R. L. Thorndike. Comprehension and Similarities are relatively sensitive pathological trends and the Vocabulary test is relatively insesitive to these trends. A measure of "scatter" is obtained by the discrepancy between the performance of the Vocabulary

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6 Ibid.
7 Geil, George A., "A Clinically Useful Abbreviated Wechsler-Bellevue Scale", Op. Cit., pp. 102-108.

and the score of the other two tests. With this in mind they set up four different testing groups.[8]

The first group consisted of 196 naval recruits with an age range of 17-20 years with a mean of 17.19. Education ranged from 5-12 years with a mean of 9.03. This normal group was not expected to show scatter.[9]

The second normal group was made up of 103 aged males with an age range of 55-58 years with a mean of 7.10, and an education range of 0-16 with a mean of 5.45. This group was expected to show scatter because of deterioration.[10]

The third group was a clinical group composed of 57 institutionalized feebleminded males with an age range of 17-26 years and a mean of 19.79. Most of them had no formal schooling.[11] They were not expected to show any scatter. The last group was a clinical group of 45 hospitalized schizophrenics who were expected to show scatter. The age range was 16-43 with a mean of 27.29 years, and an education range of 7-15 years with a mean of 10.16.[12]

The results of this experiment show that only 19% of either the naval or feebleminded groups showed scatter (lower

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8 Hunt, W. A., French, Elizabeth G., Klebanoff, S. G., Mensh, I. N., and Williams, M., "Clinical Possibilities of an Abbreviated Individual Test", OP. Cit., p.171.
9 Ibid.
10 Ibid.
11 Ibid.
12 Ibid.

score on comprehension and similarities than on vocabulary) as compared with the 62% of the schizophrenic group and 82% of the aged group that exhibited it. This particular short form test therefore has value in its sesitivity to deterioration and to detection of schizophrenia. Its authors advocate its use in screening recruits for military service with an arbitrarily assigned cut-off score.[13]

C. H. Patterson stated that a short form test used to screen large numbers, the majority of whom are normal, should prove its effectiveness in predicting full scale scores in a normal population of a wide range of IQ's. Patterson used 100 cases of full scale Wechslers, including Vocabulary, which he divided into three groups.[14]

The first group was composed of 40 male veterans, aged 18-34, with a mean age of 22.9. The education range was 3-14 years with a mean of 9.75, and an IQ range of full scale scores of 78-134 with a mean IQ of 103.8.[15]

The second group was made up of 27 normal males, aged 13-38, with a mean age of 24.4. The education range was 5-16 years with a mean of 10.9, and a full scale IQ range of 70-135

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13 Op. Cit., pp. 172-173.
14 Patterson, C. H., "Further Study of Two Short Forms of the Wechsler-Bellevue Scale", Journal of Consulting Psychology, Science Printing Co., Lancaster, Pa., Vol. XII, No. 3, May-June 1948, pp. 147-148.
15 Ibid.

with a mean of 108.0.[16]

Group three consisted of 31 highway patrolmen, aged 25-35 with a mean of 30.1. The educational range was 9-16 years with a mean of 12.6, and the range of IQ's was 98-131 with a mean of 116.[17]

The total group of 100 was above average in intelligence and education with a mean IQ of 108.83 and a mean education of 10.96 years. Patterson administered two short form tests to this group. The first test was composed of Vocabulary, Comprehension, Block Design, and Picture Completion; the second test included Vocabulary, Comprehension, and Digit Symbol. The four-test form correlated .955 with the Wechsler Full Scale, and the three-test form correlated .896 with the full scale. These correlations are in terms of weighted scores. The average difference between the actual full scale score and the four-test short form score was 6.12, and it was 7.57 for the three-test form.[18]

The results show that the four-test form predicted the total score better at the lower levels, and became less accurate as the IQ level increased. The three-test form predicted the score better at the higher IQ levels, thus indicating that

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16 Ibid.
17 Ibid.
18 Op. Cit., pp. 148-149.

short forms vary in their accuracy of prediction at various levels of intelligence. Patterson states that Vocabulary is one of the best single measures of intelligence. It correlates .85 with the total Wechsler (the highest of all the tests), and it is useful in clinical appraisal. Vocabulary gives insight into the thought processes of the subject and is especially useful in determining schizophrenic trends through bizarre definitions. It holds up well with age. Patterson suggests that Comprehension and Vocabulary be administered to the subject, and on the basis of the score obtained decide whether to give the three or four test form, thus overcoming the discrepancy in prediction at different IQ levels.[19]

In an earlier article, Patterson reviewed the short form Wechsler tests to date. He took 50 patients in an overseas army general hospital specializing in the care of closed-ward psychiatric patients. The group included the major psychotics and some organics, 20% of whom were Negroes. The age range was 19-37 years, with a mean of 23.4, and an education range of 2 to 14 years with a mean of 7. The full scale Wechsler IQ's ranged from 51-116 with a mean of 77.[20]

Patterson obtained correlations of five short form tests with the results found when he administered them to his

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19 Op. Cit., pp. 150-152.
20 Patterson, C. H., "A Comparison of Various 'Short Forms' of the Wechsler-Bellevue Scale", Op. Cit., pp. 261-262.

sample. He compared these with the correlations given for each short form by the respective authors. The Vocabulary test was not included in the verbal or full scale correlations and computations.[21]

The first short form was composed by Cummings and consisted of 420 male recruits of questionable intelligence. The age range was 17-40 with a mean of 21.26, and an educational range of 0-12 with a mean of 4.74. The range of full scale IQ's was 48-98 with a mean IQ of 73.34, 32% of them being mentally deficient. Cummings gave a correlation of .933 between the short form and the full Wechsler; Patterson found a correlation of .939 when he administered it to his sample. The short form was composed of Arithmetic and Comprehension, and consequently correlated very low with the performance scale of the Wechsler. The average difference between the actual full scale score and the short form equivalent was 12.4.[22]

The second short form considered by Patterson was originated by Geil. He used a group of 250 prisoners of the Medical Center for Federal Prisoners at Springfield, Missouri. The IQ range was 40-133 with a mean of 90.30. His short form consisted of Comprehension, Similarities, Digit Span, and Block Design. He reported a correlation of .966 between the short form score

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21 Op. Cit., pp. 262-266.
22 Ibid.

and the full scale; Patterson obtained a correlation of .936 with his sample. The average difference between the short form score and the full scale was 7.1. His other short form was made up of Information, Picture Completion, Picture Arrangement, and Digit Symbol. Geil gave a correlation of .952 for this short form; Patterson reported a correlation of .948. The average difference between the short form score and the full scale score was 7.4.[23]

The third test studied was composed by Springer and included 100 Navy men of suspected mental retardation. The age range was 20-24, and the IQ's ranged from 67 to 119 with a mean of 82.95 (no mental deficients). Springer's test included Arithmetic, Comprehension, and Similarities. He found a correlation of .92 with the full scale; Patterson obtained a correlation of .890. The average difference between the short form score and the full scale was 11.0.[24]

Gurvitz was the author of the fourth short form which was made up of Digit Span and Picture Arrangement. The group he used included 523 adult male prisoners with an age range of 17-64 and an IQ range of 42-147. Gurvitz presented a correlation of .90; Patterson gave a correlation of .815 when applied to his sample. The average difference between the short form and the full scale score was 11.2.[25]

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23 Ibid.
24 Ibid.
25 Ibid.

The final short form studied by Patterson was composed by Rabin. He used one group of 92 female student nurses with an IQ range of 85-130, and a second group of 200 hospital patients. Of the latter group 128 were males and 72 were females; the IQ range was 39-122. His test was made up of Arithmetic, Comprehension, and Similarities. For the group of nurses, Rabin reported a correlation of .80 between the short form and the full scale, and for the patients he reported a correlation of .956; Patterson gave a correlation of .890 when used with his sample. The average difference between the score obtained by the short form and the full scale score was 11.0.[26]

Patterson concluded from these results that the correlation with the verbal or performance scales is higher when the tests, or more of the tests, are from the particular scale. He further stated that the more tests included in the short form, the greater the relationship to the full scale. The two short forms used by Geil contained four tests each, and they deviated less than any of the other short forms in relation to the actual full scale score (7.1 and 7.4). Patterson finally concluded that short forms including tests from both verbal and performance scales show a greater relationship to the full scale.[27]

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26 Ibid.
27 Ibid.

III

THE CONSTRUCTION OF THE SHORT FORM TEST

The construction of the three test short form Wechsler scale was done in two parts, and entailed the use of two groups, namely a pre-selected group and an experimental group.

Pre-Selected Group

This group consisted of 45 cases with the following distribution: 11 normals, 3 schizophrenics, 3 psychopathics, 3 psychoneurotics, 3 psychotics, 3 emotionally maladjusted, 2 morons, 2 imbeciles, 2 feeble-minded, 1 epiliptic, and 12 with no specific diagnosis. The Wechsler scales of all of these subjects did not include the Vocabulary test.

The following eight combinations of three-test forms were applied to the 45 cases using the formula: $X = \frac{\text{Short Form Score}}{3} \times 10$:

1. Similarities, Block Design, Digit Symbol
2. Comprehension, Block Design, Digit Symbol
3. Information, Block Design, Digit Symbol
4. Similarities, Arithmetic, Digit Symbol
5. Comprehension, Similarities, Block Design

6. Information, Picture Arrangement, Digit Symbol

7. Similarities, Block Design, Picture Arrangement

8. Comprehension, Block Design, Picture Arrangement

The derived score from each combination was then compared with the full scale weighted score on the basis of accurate prediction. The combination of Comprehension, Similarities, and Block Design proved to be the best combination for predicting the full scale score.

A correlation using the Pearson Product Moment Method and Scatter Diagram was made on the 45 cases between the scores derived by the C. S. B. (the new short form Comprehension, Similarities, and Block Design) and the total weighted scores of the full scale Wechsler. The correlation was .937.*

Experimental Group

The writer then took 84 new cases of the following distribution: 11 normals, (college students) 7 psychopathics, 5 organics, 8 schizophrenics, 8 psychoneurotics, 3 psychotics, 3 emotional maladjustments, 3 personality maladjustments, 3 borderline intelligence, 5 feeble-minded, 3 morons, 1 imbecile, 1 senile, and 23 with no specific diagnosis.

Distribution of the Experimental Group

N = 84	Age Range - 13-67	Mean Age 25.27
Full Scale (without vocabulary)	IQ Range - 37-130	Mean IQ 84.8
	48 Females - 36 Males	11 Normals, 73 Abnormals

* - See appendix A for statistical computation.

Diagram was made on the 84 cases between the scores obtained on the C. S. B. (short form) and the total weighted scores of the full scale Wechsler. The correlation was .964.*

The following tables present the clinical breakdown of groups and their relation to the short form and total scores:

1. Comparison Between Full Scale and Short Form

Group (No.)	Weighted Score Full Scale	Short Form
Organics (5)	76.8	81.3
Psychopathics (7)	94.4	96.6
Psychoneurotics (8)	79.8	82.0
Personality Maladjustments (4)	69.3	75.5
Emotional Maladjustments (4)	79.0	79.1
Imbecile (1)	17.0	30.0
Psychotic (3)	56.0	71.0
Schizophrenic (8)	65.3	74.1
Feeble-Minded (5)	32.2	39.9
Moron (3)	18.6	24.4
No Diagnosis (23)	61.0	62.2

* - See appendix B for statistical computation.

Table I cont.

Group (No.)	Weighted Score Full Scale	Short Form
Borderline (2)	62.0	63.3
Senile (1)	12.0	20.0
Normal (11)	114.0	126.3
Total Abnormal (73)	64.1	68.3
Total (84)	70.6	75.9

II. Comparison Between Actual Full Scale Scores and Short Form Scores

Group	Mean Difference Between Actual Score and Obtained Score	Range of Difference	Correction Constant
Organics	5.9	-3.7 to +16.6	-5.2
Psychopathic	9.8	-12.4 to +21.6	-6.0
Psychoneurotic	6.9	-7.7 to +15.0	-5.8
Personality Maladjustment	6.8	-1 to +12.6	-6.5
Emotional Maladjustment	4.9	-917 to +8.6	-2.5
Imbecile *	---	----------	----
Psychotic	18.0	-4.4 to +17.3	-11.7
Schizophrenic	11.0	-8.7 to +22.6	-9.9

* - Insufficient number of cases.

Table II cont.

Group	Mean Difference Between Actual Score and Obtained Score	Range of Difference	Correction Constant
Feeble-Minded	8.3	-1.4 to +14.6	-7.5
Moron	8.6	-4.4 to +13.6	-5.7
No Diagnosis	7.3	-12.4 to +17.0	-1.1
Borderline	4.1	-3.3 to +6.0	-1.3
Senile*	---	----------	----
Normal	11.9	+5.3 to +27.6	-11.9
Total Abnormal	7.9	-12.4 to +22.6	-4.7
Total (84)	8.3	-12.4 to +27.6	-5.7

Differences of five or six points between the weighted scores of the full scale and the short form are equivalent to three or four IQ points. The following table presents the IQ's derived from the short form as compared with the full Wechsler in respect to intelligence levels:

III. Comparison of Short Form and Full Scale IQ's at Classified Levels

Group (No.)	Mean IQ Full Scale	Mean IQ Short Form	Mean Difference	Correction Constant
Defective 65 and below (20)	55.25	58.5	6.75	-5.05
Borderline 66-79 (18)	72.38	76.5	6.5	-5.8
Dull Normal 80-90 (11)	83.9	86.6	6.3	-4.5

* - Insufficient number of cases.

Table Cont.

Group (No)	Mean IQ Full Scale	Mean IQ Short Form	Mean Difference	Correction Constant
Average 91-110 (19)	99.1	101.6	3.5	-3.0
Bright Normal (8)	114.2	121.3	8.5	-8.5
Superior	123.5	130.3	6.8	-6.8
Very Superior	129.5	143.5	13.0	-13.0

Tables I and II reveal that the abnormal patients give more accurate predictions from the short form to the total score than the normals. It must be recognized, however, that this group of normals represents a very select sample in intelligence level, for the records of college students are much higher than the average population standards (the range of these 11 normal records in terms of IQ is 111-130). A comparison of tables I and II with table III shows that similar patterns of accuracy stand out even though the grouping is different. In table III it can be seen that the short form test predicts IQ's better at the lower levels of intelligence, and that accuracy decreases as the intellectual level increases. It is possible that the two factors of abnormality and low intelligence are operating simultaneously to affect the results, but the present sample is not large enough to isolate these two variables.

The Correction Constant given in tables II and III may be used in different ways. In terms of weighted scores the correction

constant for a particular group may be applied to a case already diagnosed in the clinic; it may be used as the total correction applied to clinical cases; it may be used as the correction applied to normal subjects. In terms of IQ's the correction may be made after the relative level of intellectual functioning has been made. The use of this correction is advocated because it will reduce the average deviation of scores on the short form from scores on the full Wechsler.

IV

SUMMARY

There is a great need for an individual test of intelligence that is brief, easy to give, and still possesses diagnostic abilities. The combination of Comprehension, Similarities, and Block Design into a short form adult intelligence test meets these criteria. The short form requires 12 to 16 minutes to give and score, depending on the adeptness of the subject. It requires a minimum amount of material and instruction. It minimizes the language factor in testing for intelligence, yet it is interesting to most adults. Similarities and Comprehension are clinically useful in uncovering bizarre thought processes, and are qualitatively valuable in their scoring methods which allow for different levels of functioning. The Block Design gives the examiner an excellent opportunity to study the subject's behavior in a new problem situation, and valuable clues to personality organization are offered in the method of attack used by the subject.

The quantitative criteria of a short form test is that it predict a score as nearly equivalent to the score of the

full scale as possible. The C. S. B. (new short form) gives a correlation of .964 with the total Wechsler-Bellevue Scale. This correlation is higher than any of those cited in the literature, with the exception of a four-test form by Geil which correlated .966. A correlation of .964 is so high that it makes the short form reliable for individual prediction as well as group prediction. The use of a reliable short form test of intelligence with individual prediction will be of great value to the clinician.

The other studies quoted in this paper consisted of either all normal group or all abnormal groups. In designing a test for actual clinical use, it is necessary to standardize it on a population that will be similar to the distribution of subjects dealt with in the clinic. It is very probable that the examiner will tests normal patients sometimes, though the abnormals will be in the great majority, and he needs to have a short form test that takes this into consideration. The C. S. B. was standardized on a group composed of 73 abnormals and 11 normals.

The normals used were college students with an IQ range much higher than the average range for normals, and the prediction of the short form at this level is not as accurate as it is at the lower levels of intelligence. The correlation of .964 was made in terms of weighted scores, and if it had been made in terms of IQ's it would be somewhat higher. The mean difference between the obtained score and the actual

score for the total 84 cases was 8.3, which is lower than the differences of the short forms by Cummings, Springer, Gurvitz, and Rabin. This difference could be lowered a great deal by using a sample composed entirely of abnormals, but this would lessen its clinical value.

The use of two verbal tests and one performance test gives a better correlation with the Wechsler as a whole and with its two scales, Verbal and Performance. This short form also provides an adequate measure of different types of intelligence, represented by abstract reasoning, common sense reasoning, practical application of intelligence, and other divisions of intelligence. It gives subjects of different levels of ability a chance to earn basic credit for their work with bonuses for superiority. The tables presented in this paper give the variations of different clinical groups and normals, and corrections are provided to increase the reliability of the measurement of the general intelligence level.

The C. S. B. requires a minimum of time and equipment for administration; it guarantees reliability to the extent of accurate individual prediction; and it is rich in its diagnostic abilities.

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VITA

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APPENDIX A

SHOWING STATISTICAL COMPUTATION OF CORRELATION MADE ON PRE-SELECTED GROUP

FORMULAS:

$$\text{Sum } X = \text{Sum } (fx)x \qquad \text{Sum } Y = \text{Sum } (fy)y$$

$$\text{Sum } X^2 = \text{Sum } (x)^2(fx)$$

$$\text{Sum } xy = \text{Sum } (fx)x \text{ for each row } (y)$$

$$\text{Sigma } x = \pm\sqrt{\frac{\text{Sum } X^2}{N} - \left(\frac{\text{Sum } X}{N}\right)^2}$$

$$\text{Sigma } y = \pm\sqrt{\frac{\text{Sum } Y^2}{N} - \left(\frac{\text{Sum } Y}{N}\right)^2}$$

$$r_{sy} = \frac{\frac{\text{Sum } xy}{N} - \left(\frac{\text{Sum } X}{N}\right)\left(\frac{\text{Sum } Y}{N}\right)}{(\text{Sigma } x)(\text{Sigma } y)} \text{ or } \frac{\frac{\text{Sum } xy}{N} - (MX)(MY)}{(\text{Sigma } x)(\text{Sigma } y)}$$

Where:

x = The numbers assigned to the class intervals on the abscissa of the diagram axis, 0 to 15 in this case

y = the numbers assigned to the class intervals on the ordinate of the diagram axis, 0 to 13 in this case

(fx) = the frequency of cases in each x column

(fy) = the frequency of cases in each y row

N = total number of cases, 45 in this problem

RESULTS:

Sum X = 363

Sum X^2 = 3555

Sum xy = 3305

Sigma x = 3.73

Sigma y = 3.62

r xy = .937

Mathmatical Procedure:

Sum X:	Sum Y:
2	0
2	2
9	4
0	6
35	12
18	10
28	42
56	28
27	32
30	27
22	20
36	55
39	48
14	52
45	
363	338

Sum X = Sum (fx)x:

x = 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

(fx) = 0 2 1 3 0 7 3 4 7 3 3 2 3 3 1 3

Sum Y = Sum (fy)y

y = 0 1 2 3 4 5 6 7 8 9 10 11 12 13

(fy) = 1 2 2 2 3 2 7 4 4 3 2 5 4 4

$\text{Sum } X^2 = \text{Sum } (x)^2 (fx)$

$(x)^2$ = 0 1 4 9 16 25 36 49 64 81 100 121 144 169 196 225

(fx) = 0 2 1 3 0 7 3 4 7 3 3 2 3 3 1 3

$\text{Sum } Y^2 = \text{Sum } (y)^2 (fy)$

$(y)^2$ = 0 1 4 9 16 25 36 49 64 81 100 121 144 169

(fy) = 1 2 2 2 3 2 7 4 4 3 2 5 4 4

$\text{Sum } X^2$:	$\text{Sum } Y^2$:
2	2
4	8
27	18
175	48
108	50
196	252
448	196
243	256
300	243
242	200
432	605
507	576
196	676
675	
3555	3130

Sum xy = Sum (fx)x for each row (y)

y =	0	1	2	3	4	5	6	7	8	9	10	11	12	13
(fx)x =	1	3	6	8	16	10	45	30	32	28	20	58	52	54

Sum xy:
0
3
12
24
64
50
270
210
256
252
200
638
624
702
———
3305

$$\text{Sigma } x = \sqrt{\frac{\text{Sum } X^2}{N} - \left(\frac{\text{Sum } x}{N}\right)^2}$$

$$\text{Sigma } x = \sqrt{\frac{3555}{45} - \left(\frac{363}{45}\right)^2}$$

$$\text{Sigma } x = \sqrt{\frac{28206}{2025}}$$

$$\text{Sigma } x = \sqrt{13.2988}$$

Sigma x = 3.73

45
45
225
180
2025

3555
45
17775
14220
159975

363
363
1089
2178
1089
131769

159975
\- 131769
28206

Square root:

3.73
√13.9288
9
67 | 4 92
4 69
743 | 2388
2229

Division:

13.9288
2025 /28206.0000
2025
7956
6075
1881 0
1822 5
58 50
40 50.
18 000
16 200
1 8000
1 6200

$$\text{Sigma } y = \sqrt{\frac{\text{Sum } Y^2}{N} - \left(\frac{\text{Sum } y}{N}\right)^2}$$

$$\text{Sigma } y = \sqrt{\frac{3130}{45} - \left(\frac{338}{45}\right)^2}$$

$$\text{Sigma } y = \sqrt{\frac{26606}{2025}}$$

$$\text{Sigma } y = \sqrt{13.1387}$$

$$\text{Sigma } y = 3.62$$

$$\sqrt{13.1387} = 3.62$$

9

66 | 4 13 — 3 96

722 | 17 87 — 14 44

45 × 45 = 225; 180; 2025

338 × 338 = 2704; 1014; 1014; 114244

3130 × 45 = 15650; 12520; 140850

140850 − 114244 = 26606

2025 | 26606.0000 = 13.1387

2025

6356 — 6075

281 0 — 202 5

78 50 — 60 75

17 750 — 16 200

1 5500 — 1 4175

$$r\,xy = \frac{\text{Sum } xy - \frac{(\text{Sume } X)(\text{Sume } Y)}{N}}{(\text{Sigma } x)\,(\text{Sigma } y)}$$

$$r\,xy = \frac{3305 - \frac{(363)(338)}{45}}{(3.73)\,(3.62)}$$

$$r\,xy = \frac{12.6577}{13.5026}$$

$$r\,xy = .937$$

363 × 338 = 2904; 1089; 1089; 122694

3305 × 45 = 16525; 13220; 148725

148725 − 122694 = 26031

2025 | 26031.0000 = 12.6577

2025

5781 — 4050

1331 0 — 1215 0

116 00 — 101 25

15750 — 14175

1 5750 — 1 4775

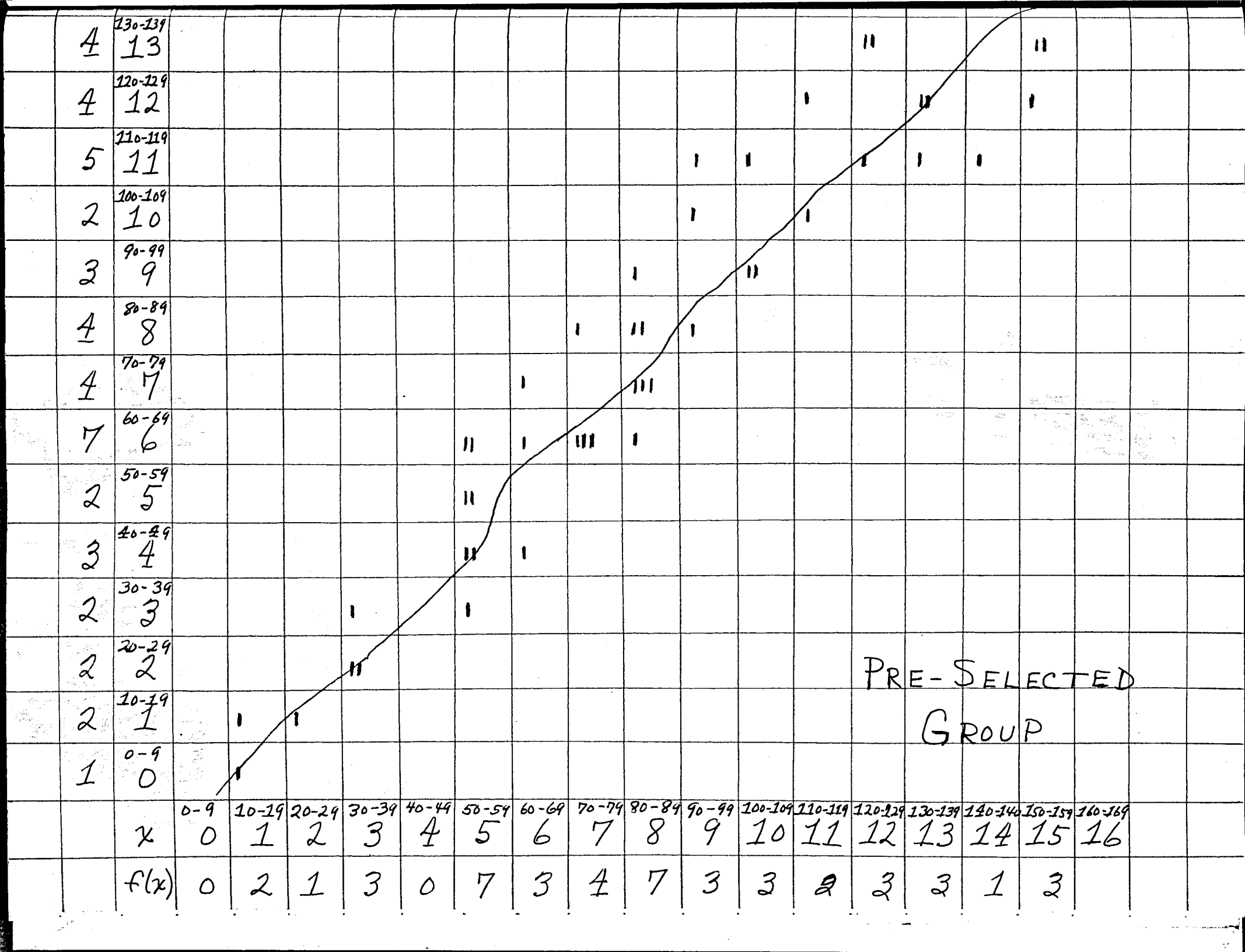
3.73 × 3.62 = 7 46; 223 8; 1119; 1350 26

135026 | 126577.000 = .937

121523 4

5053 60 — 4050 78

1002 820 — 945 182


4 130-139 13
4 120-129 12
5 110-119 11
2 100-109 10
3 90-99 9
4 80-84 8
4 70-79 7
7 60-69 6
2 50-59 5
3 40-49 4
2 30-39 3
2 20-29 2
2 10-19 1
1 0-9 0
PRE-SELECTED GROUP
x 0-9 10-19 20-29 30-39 40-49 50-54 60-69 70-79 80-84 90-99 100-109 110-119 120-129 130-139 140-140 150-159 160-169
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
f(x) 0 2 1 3 0 7 3 4 7 3 3 2 3 3 1 3

APPENDIX B

SHOWING STATISTICAL COMPUTATION OF CORRELATION MADE ON EXPERIMENTAL GROUP

FORMULAS:

$$\text{Sum } X = \text{Sum } (fx)x \qquad \text{Sum } Y = \text{Sum } (fy)y$$

$$\text{Sum } X^2 = \text{Sum } (x)^2(fx) \qquad \text{Sum } Y^2 = \text{Sum } (y)^2(fy)$$

$$\text{Sum } xy = \text{Sum } (fx)x \text{ for each row } (y)$$

$$\text{Sigma } x = \sqrt{\frac{\text{Sum } X^2}{N} - \left(\frac{\text{Sum } X}{N}\right)^2}$$

$$\text{Sigma } y = \sqrt{\frac{\text{Sum } Y^2}{N} - \left(\frac{\text{Sum } Y}{N}\right)^2}$$

$$r\ sy = \frac{\frac{\text{Sum } xy}{N} - \left(\frac{\text{Sum } X}{N}\right)\left(\frac{\text{Sum } Y}{N}\right)}{(\text{Sigma } x)\ (\text{Sigma } y)} \text{ or } \frac{\frac{\text{Sum } xy}{N} - (MX)\ (MY)}{(\text{Sigma } x)\ (\text{Sigma } y)}$$

Where:

x = the numbers assigned to the class intervals of the abscissa of the diagram axix, 0 to 16 in this case

y = the numbers assigned to the class intervals of the ordinate of the diagram axix, 0 to 13 in this case

(fx) = the frequency of cases in each x column

(fy) = the frequency of cases in each y row

N = total number of cases, 84 in this problem

RESULTS:

Sum X = 363 Sum Y = 571

Sum X^2 = 5692 Sum Y^2 = 4881

Sum xy = 5229

Sigma x = 3.64

Sigma y = 3.44

r xy = .964

Mathmatical Procedure:

Sum X:	Sum Y:
0	0
3	5
10	10
15	9
24	32
45	45
48	72
77	56
56	64
72	45
50	20
33	99
36	36
91	78
14	
30	
16	
620	571

Sum X = Sum (fx)x

x = 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

(fx) = 0 3 5 5 6 9 8 11 7 8 5 3 3 7 1 2 1

Sum Y = Sum (fy)y

y = 0 1 2 3 4 5 6 7 8 9 10 11 12 13

(fy) = 1 5 5 3 8 9 12 8 8 5 2 9 3 6

$\text{Sum } X^2 = \text{Sum } (x)^2 (fx)$

X = 0 1 4 9 16 25 36 49 64 81 100 121 144 169 196 225 256

(fx) = 0 3 5 5 6 9 8 11 7 8 5 3 3 7 1 2 1

$\text{Sum } Y^2 = \text{Sum } (y)^2 (fy)$

y = 0 1 4 9 16 25 36 49 64 81 100 121 144 169

(fy) = 0 5 5 3 8 9 12 8 8 5 2 9 3 6

$\text{Sum } X^2$:

3
20
45
96
225
288
539
448
648
500
363
432
1183
196
450
256
5692

$\text{Sum } Y^2$:

5
20
27
128
225
432
392
512
405
200
1089
432
1014
4881

```
   84
   84
  ---
  336
 672
 ----
 7056

   620
    620
  -----
  12400
 3720
 ------
 384400
```

$$\text{Sigma } x = \sqrt{\frac{\text{Sum } X^2}{N} - \left(\frac{\text{Sum } X}{N}\right)^2}$$

$$\text{Sigma } x = \sqrt{\frac{5692}{84} - \left(\frac{620}{84}\right)^2}$$

$$\text{Sigma } x = \sqrt{\frac{93728}{7056}}$$

$$\text{Sigma } x = \sqrt{13.3543}$$

$$\text{Sigma } x = 3.64$$

```
    5692
      84
   -----
   22768
  45536
  ------
  478128

   478128
 - 384400
   ------
    93728
```

```
          3.64
       /13.2834
      V  9
  66  /  428
     /   396
 724/     3234
  /       2896
```

```
            13.2834
 7056 / 93728.0000
        7056
        23168
        21168
         20000
         14112
          58880
          56448
           24320
           21168
            31520
            28224
```

Sum xy = Sum (fx)x for each row (y)

y = 0 1 2 3 4 5 6 7 8 9 10 11 12 13

(fx)x = 0 12 9 12 38 49 75 60 68 46 21 104 41 84

$$\text{Sigma } y = \sqrt{\frac{\text{Sum } Y^2}{N} - \left(\frac{\text{Sum } Y}{N}\right)^2}$$

$$\text{Sigma } y = \sqrt{\frac{4881}{84} - \left(\frac{571}{84}\right)^2}$$

$$\text{Sigma } y = \sqrt{\frac{83963}{7056}}$$

$$\text{Sigma } y = \sqrt{11.8995}$$

Sigma y = 3.44

Sum xy:
0
12
18
36
152
245
450
420
544
414
210
1144
492
1092
5229

84
84
336
672
7056

571
571
571
3997
2855
326041

4881
84
19524
39047
410004

410004
- 326041
83963

```
      11.8995
7056 / 83963.0000
       7056
      13403
       7056
      63470
      56448
      70220
      63504
      67160
      63504
      36560
      35280
```

```
        3.44
     / 11.8995
       9
  64 / 2 89
       2 56
 684 /   3395
         2736
```

$$r_{xy} = \frac{\text{Sum } xy - \frac{(\text{Sum } X)(\text{Sum } Y)}{N}}{(\text{Sigma } x)(\text{Sigma } y)}$$

$$r_{xy} = \frac{5229 - \frac{(620)(571)}{84}}{(84)(84)}$$

$$r_{xy} = \frac{85216}{7056}$$

$$r_{xy} = \frac{12.5216}{12.0770}$$

$$\underline{r_{xy} = .964}$$

571
620
11420
3426
354020

5229
84
20916
41832
439236

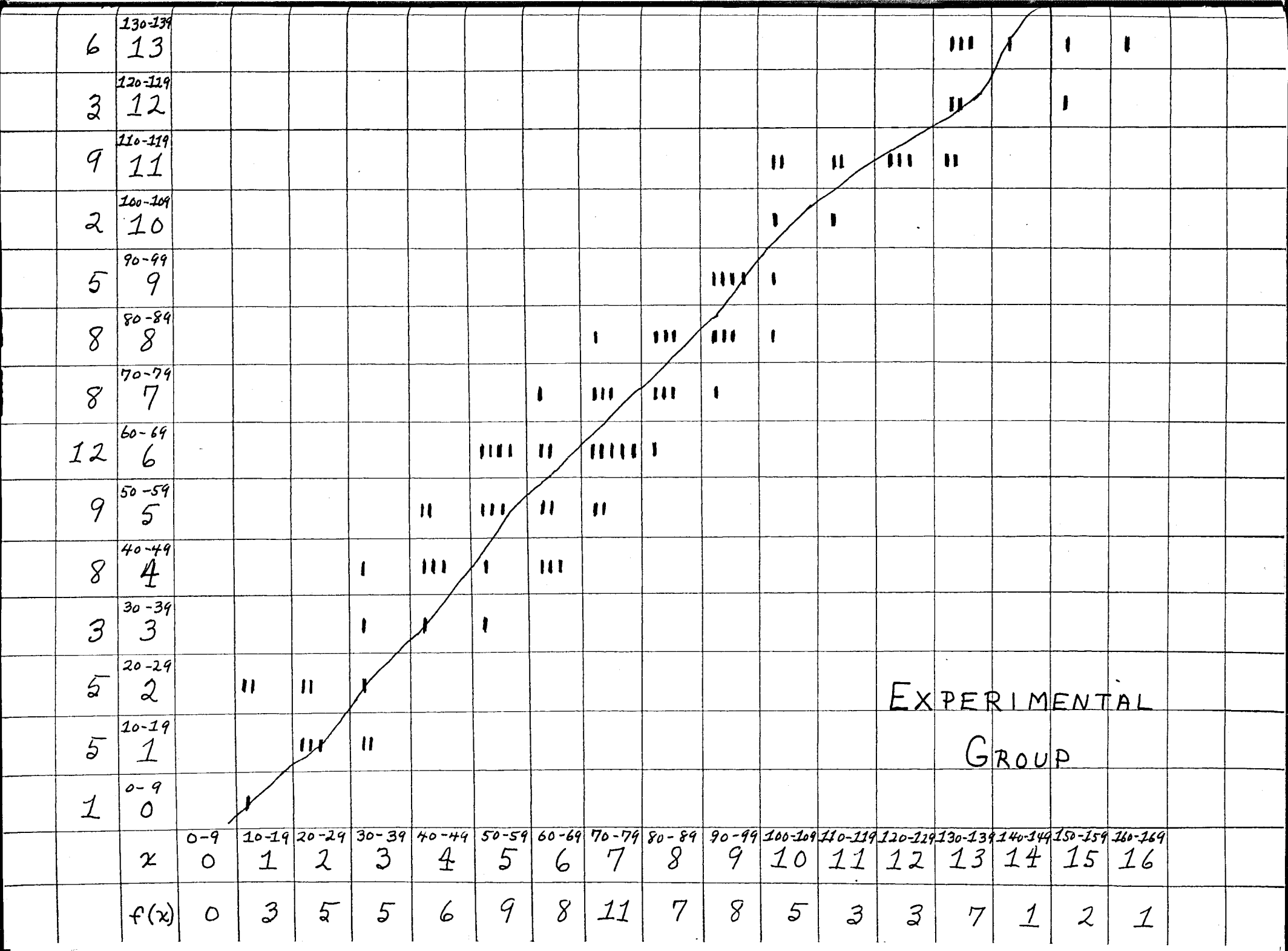
439236
- 354020
85216

$$125216 \overline{)\,120770.000} \quad 964$$

112694 4
807560
751296
562640
500864

$$7056 \overline{)\,85216.0000} \quad 12.0770$$

7056
14656
14112
54400
49392
50080
49392
6080



	x	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100-109	110-119	120-129	130-139	140-149	150-159	160-169
	f(x)	0	3	5	5	6	9	8	11	7	8	5	3	3	7	1	2	1