

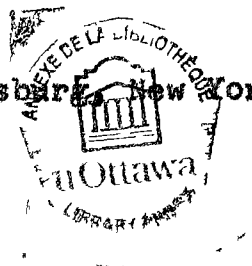
A FACTOR ANALYTIC STUDY OF THE
QUANTITATIVE H-T-F

by

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Thesis presented to the School
of Psychology and Education of
the University of Ottawa as
partial fulfillment of the
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of Doctor of Philosophy

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CURRICULUM STUDIORUM

John J. Digiammo was born September 21, 1931 in North Bergen, New Jersey. He received the Bachelor of Science degree in Psychology from Seton Hall University, South Orange, New Jersey, in 1953. He received the Master of Science degree in Clinical Psychology from the College of William and Mary, Richmond, Virginia, in 1955. The title of his thesis was Relationship Between Performance on Visual-Form Perception Measures and Drawings on the H-T-P Technique.

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INTRODUCTION

The clinical use of drawings in the study of personality has a high place in the psychologists armamentarium and ranks closely with the Rorschach and the TAT as shown in a recent survey by Sundberg¹. The large majority of evaluations concerning personality characteristics are based on clinical intuition and it appears that many of these are of doubtful validity. Very little is reported in the literature in terms of attempts to quantify and objectify some of the bases of these global evaluations. The H-T-P which has a carefully designed quantitative scoring system is a case in point. Over ninety per cent of the research on this technique is concerned with strictly qualitative aspects.

Hypotheses have been advanced concerning the differential value of H-T-P quantitative scores as a basis for qualitative evaluation. This report is concerned with studying the quantitative scores of the H-T-P via factor analytic methods in order to ascertain whether they have differential meanings which are logically consistent with those set forth by the author. An aim of the study then is to attempt to bring the clinical and statistical procedures into somewhat closer alignment.

¹ Norman D. Sundberg, "The Practice of Psychological Testing in Clinical Services in the United States", in American Psychologist, Vol. 16, 1961, p. 79-83.

The study could be important from a theoretical point of view in terms of providing some direct evidence for or against the acceptance of the quantifiable aspects of the test as a basis for further objective personality evaluation.

The first portion of this thesis is concerned with a review of the literature concerning the evaluation of the quantitative aspects as measures of intelligence, abilities and in terms of reliability.

The formulation of the basic hypothesis is followed by a description of the experimental design emphasizing the description and administration of the psychometric battery, the sample, reliability and statistical procedures applied to the data.

The results obtained are then presented and discussed. The discussion evaluates the quantitative aspects of the test as they relate to reliability and differential value of the scores. An implication for further research is indicated, and in the appendix, the raw data concerning the extraction of factors, the rotations and the calculation of B-coefficients are given.

CHAPTER I

REVIEW OF THE LITERATURE

The free hand drawing of house, tree and person (hereafter referred to as the H-T-P) as a projective technique was introduced in 1948 after ten years of study and clinical usage. According to Buck:

The H-T-P is a technique designed to aid the clinician in obtaining information concerning the sensitivity, maturity, flexibility, efficiency, and the degree of integration of a subject's personality; and the interaction of that personality with its environment-both specific and general.¹

Although primarily devised as a projective technique, it contains a carefully designed quantitative procedure which yields a number of IQ scores. The scoring scheme takes into account the details, proportion, perspective and omissions in the drawings. A careful analysis of the 140 drawings in the quantitative standardization group revealed that the items of detail, proportion and perspective best served to differentiate between subjects of various levels of intelligence. Aside from the many basically qualitative aspects of the test, the author

¹ John N. Buck, "The H-T-P Technique, A Qualitative and Quantitative Manual", in Journal of Clinical Psychology, Monograph Supplement No. 5, 1948, p. 3.

postulates that the "H-T-P is a valid measure of intelligence despite its restricted and unconventional approach to such measurement".²

A highly interesting and potentially fruitful approach to the interpretation of the H-T-P is suggested by Buck³ in what he refers to as the Quality of the Quantity; a technique which involves the utilization of the obtained IQ scores as an objective basis for qualitative interpretation of the personality. In regard to this approach, several postulates have been offered by Buck concerning the kinds and degrees of intelligence measured by the four scores:

The Raw G IQ, which is derived from raw points only, without consideration of more than their gross differentiation as Good and Flaw respectively, seems largely to represent the quantity of a subject's creativity; to emphasize how much he does. The Net Weighted score which is derived by subtracting the weighted Flaw score from the weighted Good score and thus accords each factor point a more refined differentiation, seems to emphasize the quality of a subject's concepts; to stress how well he does something. The Good IQ score, which is estimated on the basis of the weighted Good points solely, seems to stress the subject's productivity, since it is a measure of his expression of details, and their size and spatial relationships. The Flaw IQ, which is based solely on the measurable errors a subject commits in producing his H-T-P, stresses his power of criticality, seems largely to emphasize his ability to appraise reality aloofly, objectively and analytically.⁴

2 Idem, ibid., p. 5.

3 John N. Buck, "The Quality of the Quantity of the H-T-P", in Journal of Clinical Psychology, Vol. 7, 1951, p. 352-356.

4 Idem, ibid., p. 352.

In the earlier monograph by Buck⁵ it was also stated that the Raw G IQ represented an evaluation of the subject's basic fund of information and understanding of basic spatial relationships and that the Net weighted IQ represented an evaluation of the subject's concept formation or more abstract type of intellectual function. It is with the quantitative and objective approach that this review is concerned. It will accordingly attempt to review the quantitative studies as they relate to:

1. The H-T-P as a measure of intelligence.
2. H-T-P scores as measures of abilities.
3. Reliability of the quantitative scoring.

The literature which reveals an extreme paucity of references to the quantitative aspects of the H-T-P will be reviewed under these three categories and summarized.

1. The H-T-P as a measure of intelligence.

Perhaps the earliest information found in the literature concerning the H-T-P and intelligence is presented by Buck⁶ in his 1948 monograph. He presents product moment correlations between the H-T-P Raw G IQ and the Wechsler-Bellevue. The correlations between the H-T-P Raw G and the Wechsler-Bellevue Verbal, Performance and Full Scale

⁵ John N. Buck, "The H-T-P Technique, A Qualitative and Quantitative Manual", in Journal of Clinical Psychology, Monograph Supplement No. 5, 1948, p. 42.

⁶ Idem, ibid., p. 48.

IQ's respectively were .699, .724, and .746; all significant beyond the .01 level. The conclusion drawn was that although the Wechsler was far more structured and stable and was designed specifically for measuring intelligence, the significant correlations offered evidence that the H-T-P also appraised intelligence.

In a study by Sloan and Guertin⁷, fifty-four white male mental defectives who were between the chronological ages of sixteen and 30 years were given the Form I of the Wechsler-Bellevue test over a period of time ranging up to four years prior to the administration of the H-T-P. In one of their tables, Sloan and Guertin show that the mean H-T-P IQ is higher than any of the three Wechsler IQ's, the differences being significant at beyond the .01 level. The correlations of the H-T-P with the Wechsler Full Scale, Verbal Scale and Performance Scales respectively were .412, .165 and .472. Although the correlations of the H-T-P with the Full Scale and Performance Scales were statistically significant, they felt that they were lower than that usually considered significant for two measures of intelligence. They further felt that the significant differences between the H-T-P and Wechsler IQ's warranted

⁷ W. Sloan and W.H. Guertin, "A Comparison of H-T-P and Wechsler IQ's in Mental Defectives", in Journal of Clinical Psychology, Vol. 4, 1948, p. 424-426.

the conclusion that the tests were not comparable, at least for their sample.

A later study by Rubin⁸ concerning the H-T-P and its relationship to the Wechsler-Bellevue utilized 108 male patients from the neuropsychiatric service of a veteran's hospital, who ranged in age from eighteen to 50 with a mean age of 30.2 and a mean educational level of ten years. Although diagnosis was not a specific criteria, many of the subjects were psychotic. From the results it was observed that the Per Cent Raw G IQ correlated highest with the Wechsler-Bellevue Full Scale IQ (r of .674), next highest with the Performance Scale (r of .634) and lowest with the Verbal Scale (r of .623). The Net weighted Score was treated in a similar manner and correlations were found to be .636 for the Full Scale, .604 for the Verbal Scale and .580 for the Performance Scale. The results from the study indicate that the H-T-P compares favorably with the Wechsler as a measure of intelligence. These findings seem to contradict the conclusions of Sloan and Guertin whose findings represent a limited sample.

⁸ Harold Rubin, "A Quantitative Study of the H-T-P and its Relationship to the Wechsler-Bellevue Scale", in Journal of Clinical Psychology, Vol. 10, 1954, p. 35-38.

2. H-T-P scores as measures of abilities.

Digianno⁹ in a study concerning the relationships of the H-T-P and spatial relations found some support for the hypothesis concerning the Raw G Score. Utilizing a sample of forty-three college students, he found the H-T-P Raw G Score to correlate .56 with the Minnesota Paper Form Board which was devised specifically as a measure of spatial ability. The Net Weighted Score and the Good Score which are supposed to measure a more refined and abstract intellectual function correspondingly correlated lower (.51 and .47 respectively) although still beyond the .01 level.

A further study by Digianno and Ebinger¹⁰ investigated the Net Weighted Score as a possible measure of abstraction using the multiple choice form of the proverbs test as a criterion. Their sample consisted of 30 psychiatric patients who were administered the H-T-P and the proverbs as part of a standard battery of psychological

⁹ John J. Digianno, "Relationship Between Performance on Visual-Form Perception Measures and Drawings on the H-T-P Technique", in Unpublished Master's Thesis, School of Clinical and Applied Psychology, College of William and Mary, Richmond Division, 1955, iv-34.

¹⁰ John J. Digianno and Ronald D. Ebinger, "The Net Weighted H-T-P Score as a Measure of Abstraction", in Journal of Clinical Psychology, Vol. 17, 1961, p. 55.

evaluation tests. The Spearman rank order correlation method was applied to the data utilizing raw scores. The Rho's between the Proverb and H-T-P scores were as follows: Net Weighted Score .67, Raw G Score .65, Good Score .65 and Flaw Score .55. The results tended to lend some support to Buck's hypothesis concerning the measurability of abstraction via the Net weighted Score. The significant Rho's of the other scores, particularly the Good and Raw G Scores casted some doubt as to whether the Net Weighted Score measured this ability any more precisely.

A recent factor analytic study of the DAP by Nichols and Strumpfer¹¹ utilized the four H-T-P scores as drawing variables among many. The study which utilized a sample of 107 male college students sought to determine empirically what dimensions were present in a number of drawings and to search for the personality correlates of these dimensions. The H-T-P scores had extremely high loadings on the first factor (.85 to .90) which was a large quality of drawing factor and negligible, zero or low minus loadings on the three other factors. This first factor which was interpreted as overall quality of drawing accounted for most of the common variance. This finding suggests that all four H-T-P scores have a great deal in common in terms of a general drawing excellence.

¹¹ Robert C. Nichols and Deodondus J.W. Strumpfer, "A Factor Analysis of Draw-A-Person Test Scores", in Journal of Consulting Psychology, Vol. 26, 1962, p. 366-369.

3. Reliability of the quantitative scoring.

Studies reporting the reliability of the scoring system are scarce in the literature dealing with the quantitative aspects of the H-T-P. Bieliauskas¹² reports on scorer reliability in a study using three separate judges. The subjects consisted of forty-three undergraduate college students who ranged in age from seventeen to 35 with a mean age of 21.7 and a standard deviation of 5.19. The correlations between scores ranged from sixty-eight to 90. The correlations on the Per Cent Raw G and Flaw Score were lower than necessary for individual prediction by a single judge. On the other hand, it was found that all the correlations were significant for group prediction. The greatest discrepancies were noted on the Raw G and Flaw Scores which raised some question as to the value of these two scores in terms of individual prediction.

Digiammo¹³ reports test-retest reliability data on the H-T-P in a pilot study. The subjects consisted of fourteen college students who were tested a month apart. The correlation coefficients for the Raw G, Net Weighted

¹² Vytautas J. Bieliauskas, "Scorer's Reliability in the Quantitative Scoring of the H-T-P Technique", in Journal of Clinical Psychology, Vol. 12, 1956, p. 366-369.

¹³ John J. Digiammo, "Relationship Between Performance on Visual-Form Perception Measures and Drawings on the H-T-P Technique", Master's Thesis, p. 22.

and Good Score respectively were .784, .748 and .742; all significant beyond the .01 level.

4. Summary and Basic Hypothesis.

Research concerning the quantitative and objective aspects of the H-T-P are few in number. Those investigating the H-T-P as a valid measure of intelligence generally conclude that the test does measure general intelligence but not in quite the strict manner as tests specifically devised for this purpose. Studies investigating the measurement of specific abilities by utilizing separate IQ scores lend some support to Buck's postulates concerning these scores but tend to cast some doubt as to the preciseness or degree to which they are mutually exclusive in terms of measuring separate abilities.

Studies concerned with reliability suggest that in terms of scorer agreement, the separate scores are sufficient for group prediction. Test-retest reliability for a technique as unstructured as the H-T-P appears sufficient.

This exploratory investigation is concerned with the general problem of studying the quantitative H-T-P scores in terms of discovering the degree to which they measure separate abilities or factors. The writer specifically sought to investigate via factor analytic means, the

degree to which factors are identifiable in the four H-T-P scores. Since the study is basically exploratory in nature, the hypothesis can simply be stated as follows: The scores on the H-T-P test differentially measure identifiable factors which are logically consistent with Buck's hypotheses.

CHAPTER II

EXPERIMENTAL DESIGN

This chapter presents the procedures which were undertaken in order to explore the hypothesis proposed in the preceding chapter. It commences with a full description of the psychometric variables utilized in the study. This is followed by a description of the administration of the test battery. Following this is a description of the sample employed in the study. Finally, an explanation and description is given of the statistical procedures utilized in the investigation.

1. The Psychometric Battery.

The test battery consisted of eleven tests which yielded 15 scores or variables. The first four variables were the H-T-P IQ scores which have been described at length in the previous chapter.

Tests five through 8 consisted of four sub-tests of Thurstone's Primary Mental Abilities, Intermediate Form AH. They were the following: Verbal Meaning, Space, Reasoning and Word Fluency. These tests were included in the battery largely for the purpose of factor identification or definition. All of them appeared to have

counterparts in the other group administered tests. Reliabilities range from seventy-two to .90 when speed of the tests is taken into consideration¹.

Variables nine and ten consisted of the two scores given by the Shipley-Institute of Living Scale for Measuring Intellectual Impairment. The scale consists of two sub-tests, a 40 item multiple-choice vocabulary test and a twenty item completion-type abstraction test. A time limit of ten minutes is imposed on each sub-test. The test was included on the belief that it would add to the further identification of an abstract and possibly a productivity factor. Reliabilities are reported by Shipley² for 322 army recruits as follows: .87 for the vocabulary sub-test, .89 for the abstract thinking sub-test and .92 for the two combined. A recent study by Sines and Simmons³ revealed a product moment correlation of .90 between the Shipley and Full Scale WAIS IQ's showing the Shipley to be an excellent short measure of general intelligence.

1 Oscar K. Burros, The Fifth Mental Measurements Yearbook, New Jersey, Gryphon Press, 1959, xxx-1292.

2 Walter C. Shipley, "A Self-Administering Scale for Measuring Intellectual Impairment and Deterioration" in Journal of Psychology, Vol. 9, 1940, p. 371-377.

3 Lloyd K. Sines and Helen Simmons, "The Shipley-Hartford Scale and the Doppelt Short Form as Estimators of WAIS IQ in a State Hospital Population", in Journal of Clinical Psychology, Vol. 15, 1959, p. 452-453.

The eleventh variable consisted of abstract scores from the multiple-choice form of the proverbs test. In this test the subject selects the best explanation among four presented choices for each of forty proverbs. The validity coefficients based on correlations with other tests of known factorial content such as the Word Knowledge test indicated that the proverbs test was a measure of verbal comprehension, particularly in the area of abstraction. Since the task involves the conversion of concrete symbols into verbal concepts or abstractions, it appears logical to assume that it measures abstract thinking. Gorham⁴ reports a split-half reliability coefficient for the multiple-choice form of the test of .88. The clinical usefulness of the test is suggested in a study by Elmore and Gorham⁵ in which the abstract score on the multiple-choice form differentiated between normals and either psychiatric group of schizophrenics or organics at the .001 level of confidence. The test was therefore included in this study for the purpose of adding to the identification of an abstract factor.

⁴ Donald H. Gorham, "A Proverbs Test for Clinical and Experimental Use", in Psychological Reports, Monograph Supplement No. 1, 1956, p. 1-12.

⁵ Clyde M. Elmore and Donald H. Gorham, "Measuring the Impairment of the Abstracting Function with the Proverbs Test", in Journal of Clinical Psychology, Vol. 13, 1957, p. 263-266.

The Revised Minnesota Paper Form Board Test, Series AA (hereafter referred to as the MPFB) constituted the twelfth variable in the study. This well known test of spatial relations consists of sixty-four items dealing with two dimensional space perception. Each test item consists of the disarranged parts of a geometrical figure and five assembled geometrical figures among which the examinee is required to pick out the one figure which is made up of the correct combination of parts. The test measures particularly well, those aspects of mechanical ability which require the capacity to visualise objects in space. The manual⁶ reports a reliability coefficient of .85 for the series AA of the MPFB. The large majority of research appear to justify its inclusion in the battery as a measure of spatial ability.

Variable thirteen consisted of the Picture Completion subtest of the Wechsler-Bellevue Intelligence Scale Form I. The test merely requires the subject to name the missing part of an incompletely drawn figure. The drawings were copied with a fine stylus and mimeographed in order to make the test suitable for group testing. This author felt that the test involved a good degree of

⁶ Rensis Likert and William H. Quasha, The Revised Minnesota Paper Form Board, New York, Psychological Corporation, 1948, p. 1-16.

critical reasoning since it seems to measure the ability to differentiate between essential and unessential details. In regard to this particular subtest Wechsler⁷ states that "it measures the individuals basic perceptual and conceptual abilities in so far as they are involved in the visual recognition and identification of familiar objects and forms". With this in mind, it was therefore included in the battery with the hopeful goal of contributing to a critical reasoning factor.

Variables fourteen and 15 consisted of the Precision and Judgment tests of the Factor Aptitude Series which are a collection of short five minute tests based on the findings of factor analysis. Bechtoldt in Burros⁸ states that reliabilities are reasonably adequate for short five minute tests. The Precision test presents the subject with a picture on the left hand side of the page with four choices to the right. The task which includes forty-eight items is to check the one which is exactly the same as the stimulus picture. This involves the ability to recognize likenesses and differences of objects as

⁷ David Wechsler, Measurement of Adult Intelligence, Baltimore, The Williams and Wilkins Company, 1944, vii-258.

⁸ Oscar K. Burros, The Fifth Mental Measurements Yearbook, New Jersey, Gryphon Press, 1959, xxx-1292.

pictorially presented and appears to involve a need for critical reasoning.

The Judgment test consists of fifty-four items in which the subject must choose from a series of four possible solutions, the answers to a series of reasoning problems consisting of numbers and letters. It appears to test the aptitude to attack and solve difficult problems, think logically and deal with abstract relations and in this respect is quite similar to the Reasoning subtest of the Primary Mental Abilities. Both the Precision and Judgment tests were included in the battery for the purpose of contributing to a critical reasoning and possible abstract or productivity factor.

2. Administration of the Test Battery.

All of the tests in the battery were group administered; the objective tests being given exactly according to manual instructions and the time limits strictly adhered to. The tests were administered to five different groups of student nurses; the size of the groups ranging from as low as 12 to as high as thirty-two. The battery was given within a one week time period for all groups. The timed tests were administered first and were given in a strictly random order. The last two tests in the battery administered to all groups were the Proverbs test and the M-T-P. The second M-T-P was given three weeks after

the first. The average time consumed for the entire battery for each subject was four hours.

The directions for the H-T-P and the Picture Completion tests required some alteration in order to make them suitable for group administration. The H-T-P directions were as follows: I want you to make me as good a free hand drawing as you can of a house, a tree and a whole person; and in that order. You may erase as much as you please and take as much time as you like to finish your drawing. A minimal post drawing interrogation followed the drawings to provide information for scoring. The questions were directed as to the number of stories in the house, the condition of the tree (dead or alive), the weather or season in the tree picture and the sex of the person drawn. All drawings were done with 2H pencils. The drawings were scored quantitatively according to the criteria set up by Buck⁹ in his manual.

The instructions for the Picture Completion test were as follows: On these two pages, you will find fifteen pictures, each with an important part missing. Look at each picture carefully and write in below in the space provided for you, the name of the missing part. You have five minutes to complete this test.

⁹ John N. Buck, "The H-T-P Technique, A Qualitative and Quantitative Manual", in Journal of Clinical Psychology, Monograph Supplement No. 5, 1948, p. 27-48.

3. The Sample.

The sample in this study consisted of 102 student nurses containing ninety-nine females and three males. They consisted of eighty-two students and psychiatric affiliates of the St. Lawrence State Hospital in Ogdensburg, New York and 20 psychiatric affiliates of the Fergus Falls State Hospital in Fergus Falls, Minnesota. The subjects ranged in age from seventeen to 26 with a mean age of 18.6 and a standard deviation of 1.46. The amount of time spent in schools of nursing ranged from one to 3 years with a mean of 2.4 years.

The subjects were merely informed that they were participating in a research project. The testing was conducted during class time and the majority of students were enthusiastic and cooperative. As an incentive, some feedback was promised in terms of general information to be given out at the request of the student.

4. Description of Statistical Procedures.

A. Test-retest Reliability.

It was deemed important to ascertain reliability of the H-T-P scores so a test-retest method was used. Thirty H-T-P tests were randomly chosen from 90 and were re-scored. The two tests were given within a 3 week period of each other. Product moment correlations were run between the

raw scores of both tests. Results are given in chapter three and discussed in chapter four.

B. Scorer Reliability.

Two separate psychologists with more than 6 years experience in quantitatively scoring H-T-P's were utilized in this part of the study. The only communication between the two was concerned with the clarification of a few scoring ambiguities in the Flaw Score and this was done previously to any scoring. Product moment correlations were then run between the raw scores calculated between scorer A and scorer B.

C. Pilot Cluster Analysis.

A preliminary cluster analysis was performed in order to become familiar with the variables and the relationship between them. Tryon's modification of Holzinger and Harmon's B-coefficient as described by Fruchter¹⁰ was the procedure utilized. The method for arranging correlation coefficients into a work sheet and the calculation of the coefficient of belonging and the criteria for a significant B was followed exactly. The results are presented in chapter three.

¹⁰ Benjamin Fruchter, Introduction to Factor Analysis, New York, D. Van Nostrand Company, Inc. 1954, xii-280.

D. Thurstone's Complete Centroid Solution.

Product moment correlations were calculated between the fifteen variables in the battery. The data was put into the form of IBM punch cards and the calculations were performed by the IBM 650 electronic computer housed at the computing center of the University of Ottawa. The resultant 102 correlation coefficients were then put into the form of a correlation matrix and the Complete Centroid method as outlined by Thurstone¹¹ (p. 161-170) was utilized in the extraction of factors, using his system of checks and reflection of test vectors. The highest correlation in each column was taken as the communality as suggested by Thurstone. The resultant centroid matrix was then rotated in terms of providing psychological meaning to the extracted factors. These results are presented in chapter three.

¹¹ L.L. Thurstone, Multiple Factor Analysis- A Development and Expansion of the Vectors of Mind, Chicago, The University of Chicago Press, 1947, xix-535.

CHAPTER III

PRESENTATION OF RESULTS

This chapter presents the main findings of the study resulting from the statistical treatment of the collected data. The findings will be presented under four main headings as follows:

1. Reliability of the H-T-P.
2. Scorer Reliability of the H-T-P.
3. Pilot Cluster Analysis.
4. Complete Centroid Solution.

1. Reliability of the H-T-P.

The calculation of product moment correlations between two sets of thirty protocols which were given three weeks apart were as follows: .70 for the Raw G Score, .49 for the Net Weighted Score, .76 for the Good Score and .50 for the Flaw Score. While these coefficients are low in terms of desired consistency, they nevertheless are all significant at beyond the .01 level. These findings are more fully discussed in chapter four.

2. Scorer Reliability of the H-T-P.

The need for indices of scorer reliability is important, particularly in an exploratory study such as this. Two scorers with a number of years experience scored the thirty randomly chosen H-T-P's independently of each other. Some needed clarification concerning a

few scoring items in the Flaw Score was the only communication carried on and this was done prior to the actual scoring. Product moment correlations calculated between the two scorers yielded the following results: .96 for the Raw G Score, .94 for the Net Weighted Score, .91 for the Good Score and .96 for the Flaw Score. These results are all highly significant and suggest that with added clarification of some scoring instructions, scorer reliability is greatly enhanced.

3. Pilot Cluster Analysis.

A cluster analysis utilizing Tryon's modification of Holzinger and Harmon's B-coefficient (coefficient of belonging) was applied to the material in the correlation matrix of table 1. The minimum value of B (1.30) as designated by these authors was adhered to. As a result of this treatment, three sets of clusters were obtained for the fifteen variables and these are presented in figures one, 2, and three. A cursory inspection of these figures reveals fairly similar profiles for the variables which appear to belong together in terms of the B-coefficient. The procedural steps and the work sheets for the determination of B are presented in Appendix 2. The process of attempting to name the clusters was one of logical inference and is discussed further in chapter four.

4. Complete Centroid Solution.

Thurstone's complete centroid method of factor analysis was applied to the data in the correlation matrix of table I. The tables revealing the extraction of factors, calculation residuals and reflection of test vectors are presented in Appendix one. Table II presents the centroid factor matrix and the loadings of the fifteen variables on the four extracted factors.

The rotations to psychological meaningfulness were then done. The six rotations are presented in Appendix 3. Rotations in planes one and 2 were clearly the first to be made because of the clear positive manifold and also because it presented the easiest case of approximating simple structure. This was accomplished by loading variables one through 4 very heavily with factor one. Rotations after this tried to preserve the heavy loadings of variables one through 4 with factor one. Factor four which is weakly identified was treated rather contemptuously since its inclusion only seemed to confuse the rotational problem. An attempt was made to reduce negative loadings as much as possible.

The final interpretation matrix along with communalities is presented in table III. These results are discussed in chapter four.

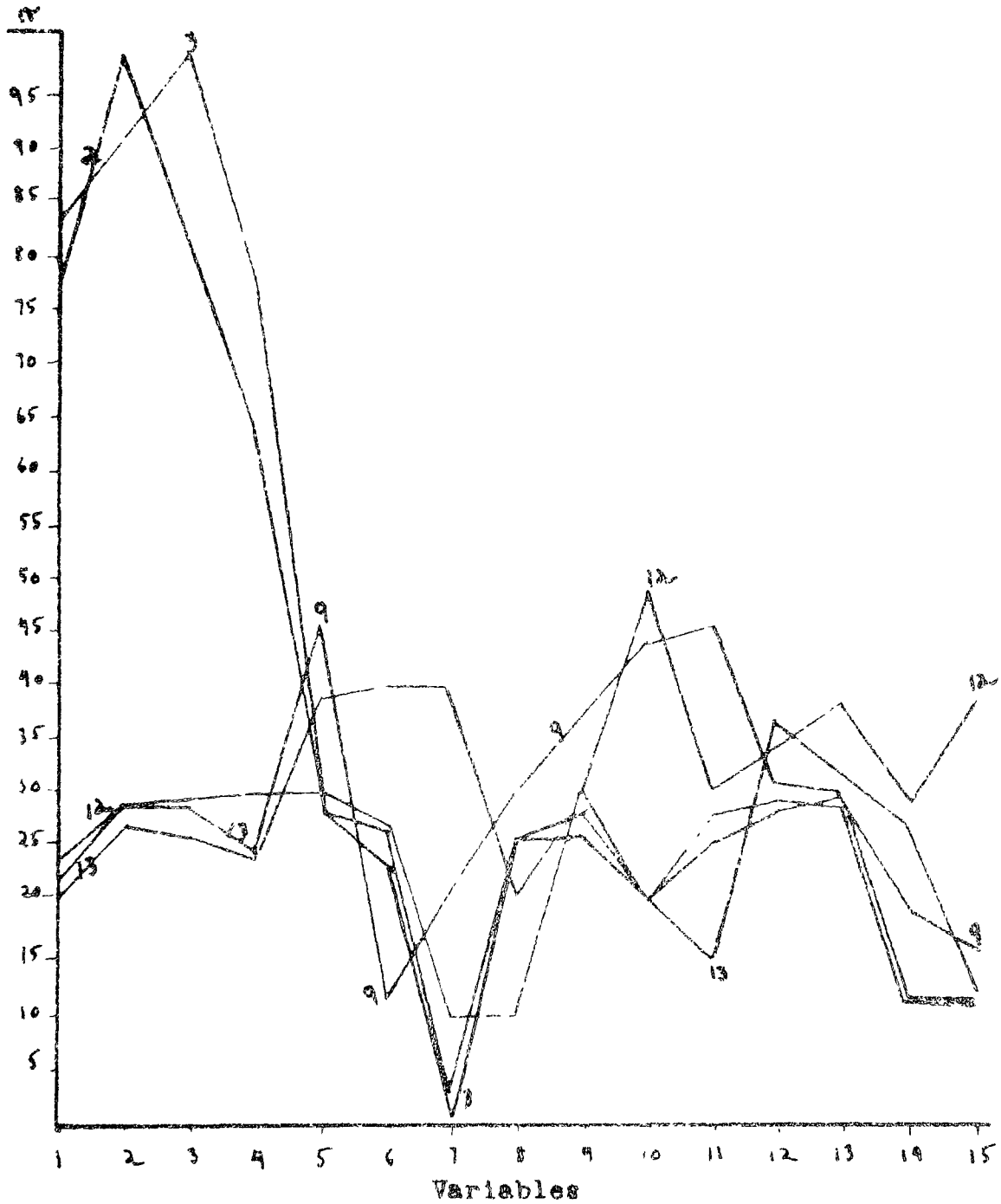


Fig. 1 Cluster 1 containing variables two, 3, twelve, 13 and nine from calculation of B-coefficient.

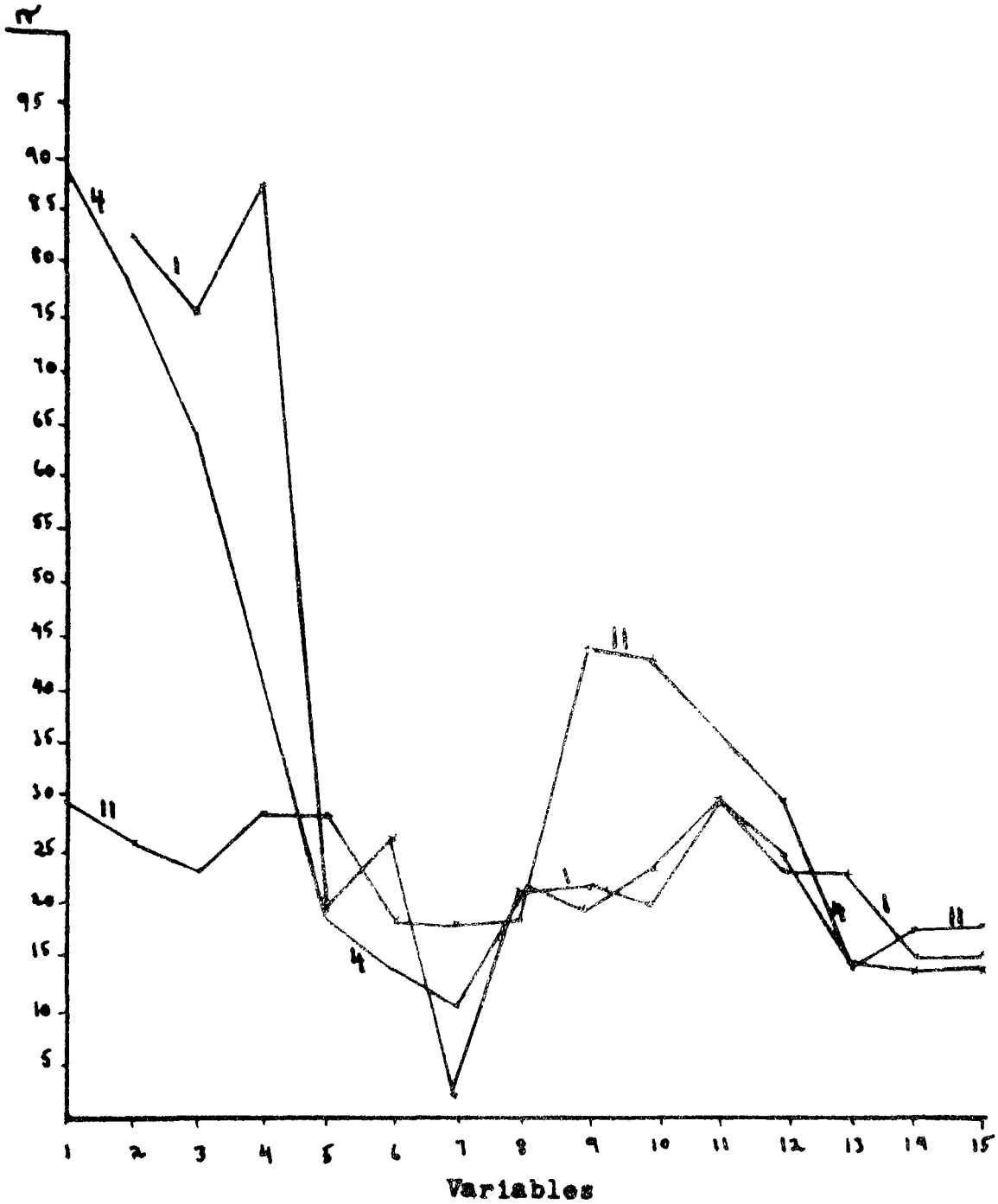


Fig. 2 Cluster 2 containing variables one, 4 and 11 from calculation of B-coefficient.

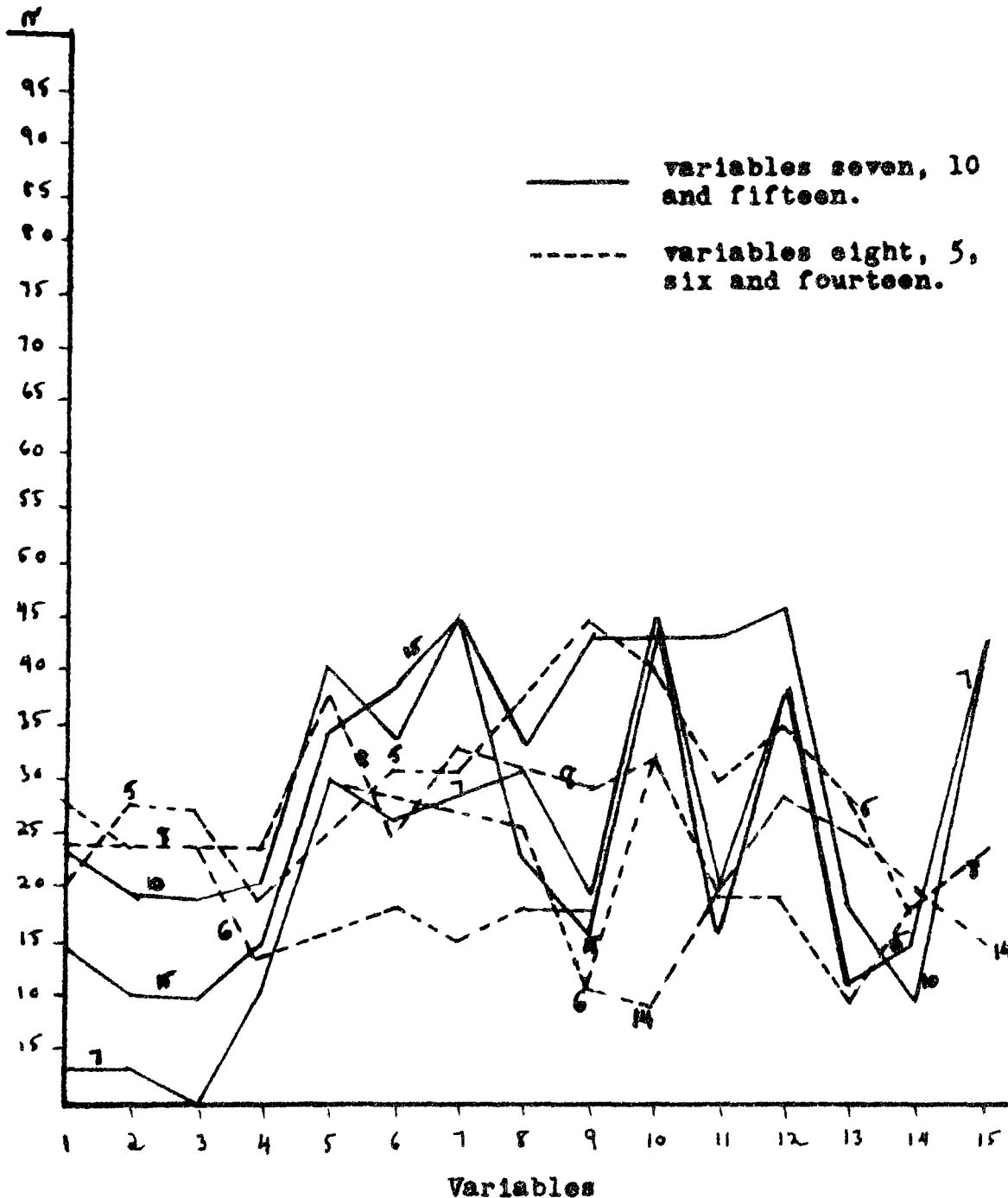


Fig. 3 Cluster 3 containing variables seven, 10, fifteen, 8, five, 6 and fourteen from calculation of B-coefficient.

Table I.

Correlation Matrix of the fifteen Variables in the Factor Analytic Study of the H-T-P

Test	M	S.D.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Raw G	113.00	4.03															
Net. wt.	108.23	3.15	83*														
Good Score	107.78	3.16	76	98													
Flaw Score	112.26	4.35	88	77	64												
PMA Verbal	39.45	2.30	20	27	26	19											
PMA Space	25.87	2.96	27	23	25	14	31										
PMA Reason	21.79	1.10	03	03	00	11	30	27									
PMA Word Fl.	48.44	2.79	23	24	23	23	38	26	31								
S-H Verbal	31.07	.75	20	27	25	23	45	12	20	30							
S-H Abstract	31.98	1.39	24	20	19	20	41	34	46	33	43						
Proverbs	32.00	1.07	30	27	24	29	28	18	17	19	45	43					
MPPB	40.68	2.35	23	29	28	24	38	40	39	19	29	47	30				
Pic. Complet.	11.10	.53	22	28	29	15	29	26	10	11	30	19	15	37			
Precision	33.93	1.79	15	11	11	14	16	17	15	18	18	10	21	29	26		
Judgment	26.52	1.34	15	11	11	15	35	39	44	24	16	43	20	38	12	15	

* Decimal points have been omitted.

Table II.-

Centroid Factor Loadings for the
Factor Analytic Study of the
H-T-P.

Tests	I	II	III	IV
1	68*	-61	10	10
2	72	-66	-12	-11
3	68	-60	-22	-17
4	64	-57	27	17
5	57	28	04	-07
6	49	18	-19	-21
7	42	40	15	-19
8	47	13	17	-19
9	53	20	15	21
10	60	36	25	-15
11	50	10	16	24
12	61	27	-26	06
13	42	08	-34	20
14	33	14	-19	27
15	47	31	07	-26

* Decimals omitted.

Table III.-

Interpretation Matrix for the Factor
Analytic Study of the H-T-P.

Tests	S	Ab.	X	CR	h^2_j
1	83*	01	40	04	85
2	98	00	13	00	98
3	95	00	00	02	90
4	73	03	55	00	84
5	23	59	03	07	41
6	31	45	-21	06	35
7	05	62	00	-10	40
8	25	46	08	-14	30
9	17	48	29	21	39
10	17	72	14	-10	57
11	21	39	33	20	34
12	31	54	-11	35	52
13	28	24	-09	44	34
14	13	24	04	40	24
15	17	58	-08	-11	39

* Decimals omitted.

CHAPTER IV

DISCUSSION OF RESULTS

This chapter presents a discussion of the results yielded by the treatment of the data and is presented as follows:

1. Reliability of the H-T-P
2. Scorer Reliability of the H-T-P.
3. Cluster Analysis.
4. Complete Centroid Solution.

1. Reliability of the H-T-P.

While the reliability coefficients on the test-retest protocols are rather low, they are nevertheless significant. These less than desirable reliabilities are not surprising when one considers that the test was designed as a projective technique and as a natural consequence is quite unstructured. It appears apparent that non-intellective factors can and do play a great part in the influence of quantitative scores. In view of this, it would appear more judicious to interpret test scores as present functioning intelligence rather than general capacity.

2. Scorer Reliability of the H-T-P.

The scorer reliabilities obtained between two independent judges ranged from .91 to .96 and indicate a good deal of consistency from scorer to scorer which

is of course commensurate with the judge's experience. These results compare favorably with those presented by Bieliauskas¹ and suggest that added clarification of scoring items greatly enhances the inter-scorer consistency.

3. Cluster Analysis.

The cluster analysis yielded three clusters whose interpretation is by no means clear. Cluster one contains variables 2 (Net Weighted Score), three (Good Score), 12 (MPFB), thirteen (Picture Completion) and 9 (Shipley Verbal). Variables two and 3 appear to have much in common and yield a B value of 3.39. Upon adding variable twelve (MPFB) to the cluster the B coefficient is drastically reduced to 1.71. Variables thirteen (Picture Completion) and 9 (Shipley Verbal) were added to the cluster; further reducing the B to 1.51 and 1.31 respectively. Since the Net Weighted and Good Score are hypothesized to measure abstraction and productivity and since the remaining three tests are speeded tests which measure proficiency and production, cluster one may be designated as a general overall productivity cluster.

Cluster two comprises variable one (Raw G Score), 4 (Flaw Score) and eleven (Proverbs). Variables one and 4 yield a B value of 2.49 which drops to 1.51 upon inclusion of eleven (Proverbs) into the cluster. All that

1 Bieliauskas, Op. Cit., p. 366-369.

one can say about this cluster is that the Raw G and Flaw Score have much in common. Since there was only one other variable in the cluster, identification was not attempted.

The third cluster contains variables seven (PMA Reasoning), 10 (Shipley Abstract), fifteen (King's Precision), 8 (PMA Word Fluency), five (PMA Verbal) and 14 (King's Precision). The B value starts at 1.85 and drops to 1.35. Since variables seven, 10, fifteen and 14 measure reasoning ability and since the PMA Space Test may be thought of as being a measure of inductive reasoning, the cluster may be thought of as being a general reasoning ability grouping.

Except for the naming of cluster one as a general overall productivity factor which lends some support to the hypothesis concerning the Good Score, little strength is given to the hypotheses concerning the other H-T-P scores. The one conclusion which is most obvious is that all four H-T-P scores have a great deal in common which is evidenced from the fairly substantial values of B which drastically drop upon the inclusion of other variables to the cluster.

4. Complete Centroid Solution.

The process of identifying the factors in table three was one of logical inference which involved inferring what the tests with high loadings on a factor had in common that was present to a lesser degree in tests with moderate loadings and absent from tests with near zero loadings. From the very beginning, it became apparent that all the H-T-P scores had high intercorrelations with each other which rendered suspect, the assumption that they were each measuring something different.

The four H-T-P scores all have high loadings on factor one. Variables six (PMA Space) and 12 (MPFB) which involve spatial ability have moderate loadings. None of the lower loadings appear to have this ability in common. Since the H-T-P scores all have high loadings and involve drawing and spatial ability and since the two space tests have moderate loadings, the first factor may be designated as a spatial one which is involved in overall drawing quality.

The loadings of the H-T-P scores on factor two are almost completely orthogonal to that factor. Variables ten, 7, five and fifteen all have moderate to fairly high loadings and involve abstraction and reasoning. This factor was designated as abstract reasoning.

Factor three contains fairly high loadings on variables one and 4 and moderate loadings on nine and 11. Variables nine and 11 appear to measure verbal ability and abstract reasoning respectively. Since some of the variables with low loadings such as seven and 5 also measure verbal ability, this factor was much too ambiguous to be named and was designated as X.

Factor four has moderate loadings on variables thirteen (Picture Completion) and 14 (Precision) which involve the critical ability to perceive errors and likenesses and differences. The rest of the variables with the exception of twelve (MPFB) have low loadings. This factor was designated as criticality. The loadings of the H-T-P scores are also orthogonal to this factor.

The results obtained from this factor study tends to cast serious doubt upon the differential values of the separate H-T-P scores and the utility of basing qualitative appraisals on them. The usefulness of global qualitative appraisals based on clinical evidence is not questioned but until the measurement is made more precise, qualitative appraisals on the basis of quantitative scoring must remain suspect. With the exception of the cluster analysis lending some support to the hypothesis concerning productivity and the Good Score, the only other definite finding is the yielding of a

spatial factor which certainly involves quality of drawing.
and which has high loadings on all four H-T-P scores.

SUMMARY AND CONCLUSIONS

In the exploratory study of the H-T-P utilizing factor analytic means, it was found that the hypotheses concerning the differential value of the four H-T-P scores received little support. The complete centroid solution as applied to the data strongly suggests that the scores as they now stand have a great deal in common. The one main finding was that the quantitative scores reflect a spatial or general quality of drawing factor which is inherent throughout the scoring system. The pilot cluster analysis lends some support to the interpretation of the Good Score as a measure of productivity.

In view of the general findings, it is felt that any qualitative analysis based on quantitative scores should be made with great caution since the basic assumption of differential meaning is strongly suspect.

In order to test whether some of the assumptions possess empirical validity, it would be interesting to investigate whether statements made on the basis of disparity of scores are corroborated by the statements which might be made from a relatively objective instrument. Broad categories of personality characteristics should be used exclusively in view of the relatively unsophisticated measurement contained in the H-T-P scoring system.

The general findings of the study do not in any way detract from the clinical usefulness of the technique but suggest the need for further research in regard to quantification procedures and a refinement in the scoring system before any credence is given to quantitatively based qualitative interpretations.

BIBLIOGRAPHY

Buck, John N., "The H-T-P Technique, A Qualitative and Quantitative Manual", in Journal of Clinical Psychology, Monograph Supplement No. 5, 1948, 11-120.

This important manual contains the data on the qualitative and quantitative standardization group and detailed instructions for quantitative scoring. The basic rationale is presented in this source and the publication is an absolute must for anyone who wishes to become conversant with the technique.

Buck, John N., "The Quality of the Quantity of the H-T-P", in Journal of Clinical Psychology, Vol. 7, 1951, p. 352-356.

This important article presents for the first time, the author's formulation for utilizing the quantitative scores as a basis for qualitative interpretation and gives reasons for his stand. A clinical and very intuitive but potentially fruitful approach.

APPENDIX 1

Worksheets showing the extraction of factors
and calculation of residuals.

Calculation of first factor loadings

TEST	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Σ	Ch.
1. Raw G	.83	.76	.88	.20	.27	.03	.23	.20	.24	.30	.23	.22	.15	.15	.15	4.69	4
2. Net Wt.	.83	.98	.77	.27	.23	.03	.24	.27	.20	.27	.29	.28	.11	.11	.11	4.88	4
3. Good Score	.76	.98	.64	.26	.25	.00	.23	.25	.19	.24	.28	.29	.11	.11	.11	4.59	4
4. Flaw Score	.98	.77	.64	.19	.14	.11	.23	.23	.20	.29	.24	.15	.14	.15	.15	4.36	4
5. PMA Verbal	.20	.27	.26	.19	.31	.30	.33	.40	.41	.28	.35	.29	.16	.35	.35	4.21	4
6. PMA Space	.27	.23	.25	.14	.31	.27	.26	.12	.34	.18	.40	.24	.17	.31	.31	3.59	4
7. PMA Reasoning	.03	.03	.00	.11	.30	.27	.31	.20	.46	.17	.39	.10	.15	.44	.44	2.96	4
8. PMA Word	.23	.24	.23	.23	.38	.26	.21	.3	.33	.19	.19	.11	.18	.24	.24	3.42	4
9. S-H Verbal	.26	.27	.25	.23	.45	.17	.20	.30	.43	.43	.29	.30	.15	.16	.16	3.83	4
10. S-H Abstract	.24	.20	.19	.20	.41	.34	.40	.33	.43	.43	.47	.19	.16	.43	.43	4.14	4
11. Proverbs	.30	.27	.24	.27	.28	.13	.17	.1	.43	.30	.30	.15	.20	.20	.20	3.66	4
12. MPFB	.23	.29	.28	.24	.38	.40	.39	.19	.29	.47	.30	.37	.29	.38	.38	4.50	4
13. Pic. Compl.	.14	.28	.29	.25	.29	.26	.10	.11	.30	.19	.12	.37	.26	.47	.47	3.57	4
14. King Precision	.15	.11	.14	.14	.16	.17	.15	.5	.15	.10	.21	.29	.24	.15	.15	2.36	4
15. King Judgment	.10	.11	.11	.15	.35	.39	.44	.24	.16	.40	.20	.28	.12	.15	.15	3.35	4

$\Sigma F = S$
 $-2B = C$
 d
 $ud = D$
 $C + D = E$
 $mE = a_j$

$T = \Sigma E_1 = 0.0$
 $\sqrt{C} = 8$
 $\sqrt{D} = 8$
 $\sqrt{E} = 8$
 $m = 8$
 $m \Sigma E = 8 \times 0.14 = 1.12$

$MT = 8.14 = \sqrt{F} (V)$
 $\Sigma |a_j| = 8.13 = mT (V)$

First Factor Loadings

Calculation of first factor residuals and second factor loadings.

b = -a		-68	-72	-68	-64	.57	-49	.42	-.41	-.33	.60	-.50	-.61	.42	-.33	-.47	-U = -8.13	
+a	Test	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Σ	Ch
68	1		.34	.30	.44	-.19	-.06	-.26	-.09	-.16	-.17	-.04	-.18	-.07	-.01	.17	-.38	✓
.72	2	.34		.49	.31	-.14	-.12	-.27	-.10	-.11	-.23	-.04	-.15	.02	-.13	.23	-.45	✓
-.68	3	.30	-.44		.20	-.13	-.08	-.29	-.09	-.11	-.22	.10	-.13	.00	-.11	-.24	-.48	✓
-.64	4	.44	.31	.20		.11	-.17	-.16	-.07	-.11	-.18	-.03	-.15	-.12	.07	-.15	-.43	✓
.57	5	.19	-.14	-.13	-.17		.03	.06	.11	.15	.07	-.01	.03	.05	.03	.08	-.09	✓
-.49	6	-.06	-.12	-.08	-.17	.03		.06	.03	-.14	.05	-.07	.10	.05	.01	.16	-.15	✓
.42	7	-.26	-.27	-.29	-.16	.06	.06		.11	-.02	.21	-.04	.13	.08	.01	.24	-.30	✓
.41	8	-.09	-.10	-.09	.07	.11	.03	.11		.05	.05	-.15	-.10	-.09	.02	.02	-.20	✓
.53	9	-.16	-.11	-.11	-.11	.15	-.14	-.02	.13		.11	.18	-.03	.08	.11	-.11	-.19	✓
.60	10	-.17	-.23	-.22	-.18	.01	.05	.21	.05	.01		.13	.10	-.06	-.10	.12	-.09	✓
.50	11	-.04	-.09	-.10	-.03	-.01	-.07	-.04	-.05	.18	.13		-.01	-.06	.04	-.04	-.19	✓
-.61	12	-.18	-.15	-.13	.15	.03	.10	.13	-.10	-.03	.10	-.01		.11	.04	.04	-.10	✓
.42	13	-.07	-.02	.00	-.12	.05	.05	-.08	-.09	.08	-.06	-.06	.11		.12	-.08	-.17	✓
-.33	14	-.07	-.13	-.11	-.07	-.03	.01	.01	.02	.01	-.10	.04	.09	.12		.01	-.22	✓
-.47	15	-.17	-.23	-.21	-.15	.08	.16	.24	.02	-.09	.15	-.04	.09	-.02	.01		-.24	✓

8.13 = U = a																	
5+ub+b²cn	-30	.40	-.49	-.44	-.09	-.16	-.28	-.19	-.20	-.10	-.16	-.10	-.15	.22	-.23	-.366	✓
Σr = S	-.38	-.45	-.48	-.43	-.09	-.15	-.30	.20	-.19	-.07	-.18	-.10	.11	-.22	.24	-.368	✓
-1/25 - A	.190	.225 (240)	.215	.040	.075	.150	-.100	.045	.045	.095	.050	.085	.10	.120	.184	✓	
r(3)	.490	(.715) (.240)	.115	-.085	-.005	-.140	.010	-.015	-.175	-.005	-.080	.085	.000	-.090	.139	✓	
+ (2)	(.830)	(.715) (.730)	.725	-.225	-.125	-.410	-.090	-.125	-.405	-.095	-.230	.065	-.130	.320	-.91	✓	
r(1)	(.830)	(.1055) (.1030) (.1165)	-.415	-.185	-.070	-.180	-.280	.575	-.135	-.410	-.105	-.200	.450	.53	✓		
B + (4)	(.1270)	(.1365) (.1230) (.1160)	-.585	-.355	-.830	.250	-.395	-.755	-.165	-.560	-.125	-.270	-.640	.10	✓		
0.2B = C	-2.54	-2.73	-2.46	-2.33	1.17	.71	1.66	.50	.19	1.51	.33	1.12	.25	.04	1.28	-.20	
d	.44	.49	.44	.44	.19	.17	.29	.11	.18	.23	.18	.18	.12	.13	.24		
ud = L	-.44	-.49	-.44	-.44	.19	.17	.29	.11	.18	.23	.18	.18	.12	.13	.24	.10	
C + D = E	-2.98	-3.22	-2.95	-2.77	1.36	.88	1.90	.61	.77	1.74	.51	1.30	.37	.67	1.52	.04	✓
mE = 2j	-.61	-.66	-.60	-.57	.28	.18	.40	.13	.20	.36	.10	.27	.00	.14	.31	.11	

Second Factor Loadings →

$$T = \sum |E_j| = 23.80$$

$$\sqrt{T} = 4.878981$$

$$1/\sqrt{T} = m = 2.04961$$

$$MT = 4.87 = \sqrt{T} (2)$$

$$\sum |a_j| = 4.89 = m \sqrt{T} (\checkmark)$$

$$= m \sum E = \sum a (V)$$

Calculation of second factor residuals and third factor loadings.

b = -a	.61	.66	.60	.57	-.28	-.18	.40	.13	.20	.36	.10	.21	.05	.14	.31	v = .01	
+ a	Test	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Σ
-.61	1																
-.66	2	-.06	-.07	.09	.07	.04	.00	.01	.01	.02	.01	.02	.03	.03	.04	.03	-.02
-.60	3	-.07	.09	-.14	.04	.03	-.05	-.01	.01	.00	.04	.03	.05	.05	.03	.02	-.11
-.57	4	-.09	-.07	-.14	-.01	-.07	.07	.00	.00	.03	.03	.00	.07	.01	.03		-.10
.28	5	-.01	.04	-.01	-.02	-.02	-.01	-.05	.07	.09	-.03	-.04	.05	.03	.07	-.01	-.03
.18	6	.05	.00	.03	.07	-.02	-.01	.01	.18	-.01	.09	.05	.04	.02	.10		-.12
.40	7	-.02	-.01	.05	.07	-.05	.01	.06	.10	.07	-.08	.02	.11	-.08	.12		-.14
.13	8	-.01	-.01	.00	.07	.01	.06	.02	.02	.00	-.06	-.14	.10	.00	.02		-.19
.20	9	-.04	.02	.01	.00	.09	-.18	-.10	.02	.04	.16	-.03	.06	.02	.15		-.17
.36	10	.05	.01	.00	.03	-.03	-.01	.07	.00	.04	.09	.00	.09	.15	.04		-.05
10	11	.02	-.02	.04	.03	.04	-.09	-.03	.06	.09	-.04	.07	.03	.07			-.18
27	12	.02	.03	.03	.00	-.05	.05	.02	.14	.08	.00	.04	.09	.05	.01		-.02
08	13	-.02	.03	.05	.07	.03	.04	-.11	.10	.06	-.07	.07	.09	.11	.10		-.15
.14	14	.02	.04	.03	.01	-.07	.02	-.05	.00	-.02	-.05	.03	.05	.11			-.21
.31	15	.02	-.03	-.02	.03	-.01	.10	.12	.02	.15	.04	.07	.01	.10	.05		-.13
.01 = v = Σ a																	
stvb + b = Ch																	
Σ v = S																	
-1/2 S = A																	
+ 14																	
+ 13																	
+ 12																	
+ 6																	
+ 3																	
B + 2																	
-2B = C																	
d																	
ud = D																	
C + D = E																	
mE = aj																	

$T = \sum |E| = 7.21$
 $\sqrt{T} = m = 2.685201$
 $\sqrt{2F} = m = 3.12411$
 $mT = 2.68 = \sqrt{F} (v)$
 $\sum |a| = 2.68 = mT (v)$

Third Factor Loading →

Calculation of third factor residuals and fourth factor loadings.

b = -a		-10	12	.22	-27	-.04	19	-15	-.17	-.15	.25	-.16	.26	.24	.19	.07	-v = -.02	
+a	TEST	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Σ	Ch
10	1		-.05	-.05	.06	-.02	.07	-.04	-.03	-.06	.02	.00	.01	.05	.04	.01	.01	✓
-12	2	-.05		.06	-.04	.04	-.02	.01	.01	.04	.04	.00	.00	-.01	-.06	-.02	.00	✓
-.22	3	-.05	.06		-.03	.05	-.01	-.02	.03	.04	.05	.00	.03	-.02	-.07	.00	-.05	✓
-.27	4	.06	-.04	-.08		-.02	-.02	.03	-.05	-.04	-.04	-.01	.07	-.02	.06	.01	-.05	✓
.04	5	.02	.04	.05	-.02		-.01	-.06	.06	.08	-.04	-.05	-.04	.04	-.06	-.01	-.04	✓
-19	6	.07	-.02	-.01	-.02	-.01		.02	.04	-.15	.04	-.06	.00	-.02	-.06	.11	-.07	✓
.15	7	-.04	.01	-.02	.03	-.06	.02		.03	-.12	.03	-.10	.06	-.06	-.02	.11	-.13	✓
-.17	8	-.03	.01	.03	-.05	.06	.04	.03		-.01	-.04	-.09	-.10	-.04	.03	-.03	-.19	✓
.15	9	-.06	-.04	.04	-.04	.08	-.15	-.12	-.01		.00	.14	-.04	.11	.01	-.16	-.16	✓
.25	10	-.02	.04	.05	-.04	-.04	.04	.03	-.04	.00		.05	.07	.00	-.10	.02	.10	✓
.16	11	.00	.00	.00	-.01	-.05	-.06	-.10	-.09	.14	.03		.00	.02	.06	-.08	-.16	✓
-.26	12	.0	.00	.03	.07	-.04	.00	.06	-.10	-.04	.07	.00		.00	.00	.03	.03	✓
-.34	13	.05	.01	-.02	.02	.04	-.02	-.06	-.04	.11	.00	-.02	.00		.05	-.08	.02	✓
-.19	14	.04	-.06	.07	.06	-.06	-.00	.02	.03	.01	-.10	.06	.00	.05		-.04	-.16	✓
.07	15	.01	-.02	-.00	.01	-.01	.11	.11	-.03	-.16	.02	-.08	.03	-.08	-.04		-.13	✓

.02 = v = 2a

3+vb+b²=Gh	.00	.01	.04	-.04	-.03	-.08	-.12	.16	-.15	-.10	-.15	.01	-.02	-.17	-.13	-.10	.01	
Σr = S	.01	.00	-.05	-.05	-.04	-.07	-.13	-.19	-.16	.10	-.16	.03	.02	-.16	-.13	-.10	-.98	✓
-½S = A	-.005	.000	.025	.025	.020	.035	.065	(.095)	.080	.050	.080	-.015	-.010	.080	.065	.059	✓	
+8	-.035	.010	.055	-.025	.080	.075	(.095)	(.095)	.070	.010	-.010	-.115	-.040	.110	.035	.400	✓	
+7	-.075	.020	.035	.005	.020	.095	.095	(.125)	-.050	.040	-.110	-.055	-.110	.090	(.145)	.270	✓	
+15	-.065	.000	.035	.015	.010	(.205)	(.205)	(.095)	-.210	.060	-.190	-.025	-.190	.050	(.145)	.140	✓	
+6	.005	-.020	.025	-.005	.000	(.205)	(.225)	(.135)	*340	(.100)	-.350	-.025	-.210	-.010	(.255)	.070	✓	
+10	.025	.020	(.075)	-.045	-.040	(.245)	(.255)	(.095)	-.360	(.100)	-.200	.045	-.210	-.110	(.275)	.170	✓	
+3	-.025	(.080)	(.075)	-.125	.010	(.235)	(.235)	(.125)	-.320	(.150)	-.200	.015	-.230	-.180	(.275)	.120	✓	
+2	-.075	(.080)	(.135)	-.165	(.050)	(.215)	(.245)	(.135)	-.280	(.190)	-.200	.015	-.240	-.240	(.275)	.140	✓	
B+5	-.095	(.120)	(.185)	-.185	(.050)	(.205)	(.195)	(.195)	-.200	(.150)	-.250	-.025	-.200	-.300	(.265)	.100	✓	
-2B = C	.19	-.24	-.37	.37	-.10	-.41	-.37	-.39	.40	-.30	.50	.05	.40	.60	-.53	-.20		
d	.07	.06	.08	.08	.08	.15	.12	.10	.16	.10	.14	.10	.11	.10	.16			
ud = D	.07	-.06	-.08	.08	-.08	-.15	-.12	-.10	.16	-.10	.14	.10	.11	.10	-.16	-.09		
C+D = E	.26	-.30	-.25	.45	-.18	-.56	-.49	.49	.56	-.40	.64	.15	.51	.70	-.69	-.29	✓	
mE = a_j	.10	-.11	-.17	.17	-.07	-.21	-.19	-.19	.21	-.15	.24	.06	.20	.27	-.26	-.10	2.60 = mΣE = Σa_j (✓)	

Fourth Factor Loadings

APPENDIX 1

T = Σ|E| = 6.83
 $\sqrt{T} = 2.613500$
 $\frac{1}{\sqrt{T}} = m = .382628$
 $mT = 2.61 = \sqrt{T} (✓)$
 $\Sigma|a_j| = 2.60 = mT (✓)$

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Calculation of fourth factor residuals.

$b = -a$.10	.14	.17	.17	.07	.21	.19	.19	.21	.15	.24	.06	.20	.27	.26	.0	.10
+a	TEST	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Σ	Ch
.10	1		-.04	-.03	.04	-.01	.09	-.02	-.01	-.08	.04	-.02	.00	.03	.01	.04	.04	✓
-.11	2	-.04		.04	-.02	.03	-.04	-.01	-.01	.06	.02	.03	.01	.01	-.02	-.05	.01	✓
-.17	3	-.03	.04		-.05	.04	-.05	-.05	.00	.07	-.02	.04	-.02	.01	-.02	-.04	-.04	✓
.17	4	.04	-.02	-.05		-.01	.02	.06	-.02	-.07	-.01	-.05	.06	-.01	.01	.05	.00	✓
-.07	5	-.01	.03	.04	-.01		-.02	-.07	.05	.09	-.05	-.03	-.04	.05	-.04	-.03	-.04	✓
-.21	6	.09	-.04	-.05	.02	-.02		-.02	.00	-.10	.01	-.01	.01	.02	.00	.06	-.03	✓
-.19	7	-.02	-.01	-.05	.06	-.07	-.02		-.01	-.03	.00	-.05	.07	-.02	.03	.06	-.11	✓
-.19	8	-.01	-.01	.00	-.02	.05	.00	-.01		.03	-.07	-.04	-.09	.00	.03	-.03	-.17	✓
.21	9	-.03	.06	.07	-.07	.09	-.10	-.03	.03		.03	.09	-.05	.07	-.05	-.10	-.09	✓
-.15	10	.04	.02	.02	-.01	-.05	.01	.00	-.07	.03		.09	.03	.03	-.06	-.02	.11	✓
.24	11	-.02	.03	.04	-.05	-.03	-.01	-.05	-.04	.09	.09		-.01	-.07	.00	-.02	-.05	✓
.26	12	.00	.01	-.02	.06	-.04	.01	.07	-.09	-.05	.08	-.01		-.01	-.02	.05	.04	✓
.20	13	.03	.01	.01	-.01	.05	.02	-.02	.00	.07	.03	-.07	-.01		.00	-.03	.03	✓
.27	14	.01	-.02	-.02	.01	-.04	.00	.03	.03	-.05	-.06	.00	-.02	.00		.03	-.05	✓
-.26	15	.04	-.05	-.04	.05	-.03	.06	.06	-.03	-.10	-.02	-.02	.05	-.03	.03		-.03	✓
$-.10 = \Sigma a$																		
$3 + 4 + 5 = Ch$		.03	.02	-.04	.00	-.05	-.05	-.11	-.17	-.10	.10	-.08	.05	.03	-.06	-.09	-.47	✓
$\Sigma r = 3$		.04	.01	-.04	.00	-.04	-.03	-.11	-.17	-.09	.11	-.05	.04	.03	-.05	-.08	-.38	✓

APPENDIX 2

Worksheets for the calculation of B-coefficients.

Insert showing correlation coefficients for each variable listed according to size.

Insert showing worksheet for calculation of B.

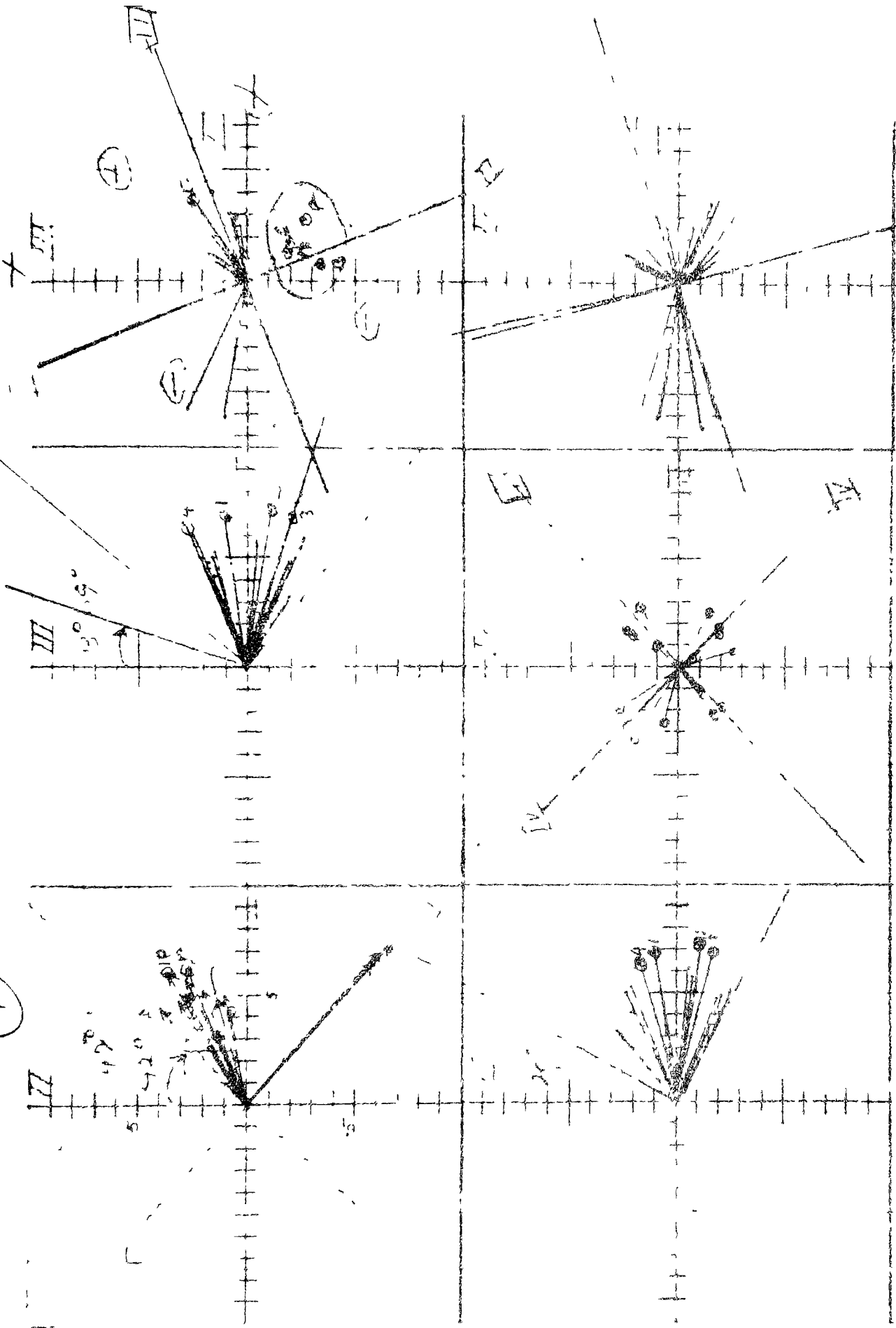
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Preceding Cluster + i	Sum of i with n Variables	Sum of Correlations between i and Variables already in Cluster	Sum of Correlations among Variables in Cluster = (3) + (4)	Sum of Correlations of Variables in Cluster = (5) - 2(3) + (6)	n = Number of Variables in the Cluster	Kernel = Number of Intercorrelations in Cluster	$n(n-k) =$ Number of Remaining Intercorrelations	Means Intercorrelation in Cluster $(6) \div (7)$	Means of the Remaining Intercorrelations $(5) \div (8)$	Reciprocal $(9) \div (10)$
B(2, 31)	$4.58 + 4.57 = 9.15$	.98	.98	7.51	2	1	26	.980	.289	3.37
B(2, 3, 12)	4.50	.57	1.55	10.97	3	3	36	.517	.302	1.71
B(2, 3, 15, 31)	3.67	.94	2.49	12.08	4	6	44	.415	.275	1.51
B(2, 3, 12, 13, 7)	3.53	1.11	3.60	13.09	5	10	50	.360	.274	1.31
B(1, 1)	$4.49 + 4.36 = 8.85$	.58	.58	9.17	2	1	26	.580	.353	2.49
B(1, 4, 11)	3.66	.57	1.47	11.65	3	3	36	.490	.324	1.51
B(7, 15, 1)	$2.96 + 4.4 = 7.36$	.46	.46	6.41	2	1	26	.460	.248	1.85
B(7, 15, 151)	3.35	.57	1.33	9.10	3	3	36	.443	.225	1.97
B(7, 15, 15, 8)	2.42	.55	2.21	9.76	4	6	44	.368	.221	1.67
B(7, 15, 15, 8, 51)	4.23	1.44	3.65	11.11	5	10	50	.365	.222	1.64
B(7, 15, 8, 5, 61)	3.57	1.57	5.22	11.56	6	15	54	.349	.214	1.63
B(7, 15, 8, 5, 6, 11)	2.31	.71	6.13	12.10	7	21	56	.291	.216	1.35

APPENDIX 3

Plots showing rotation of reference axes.

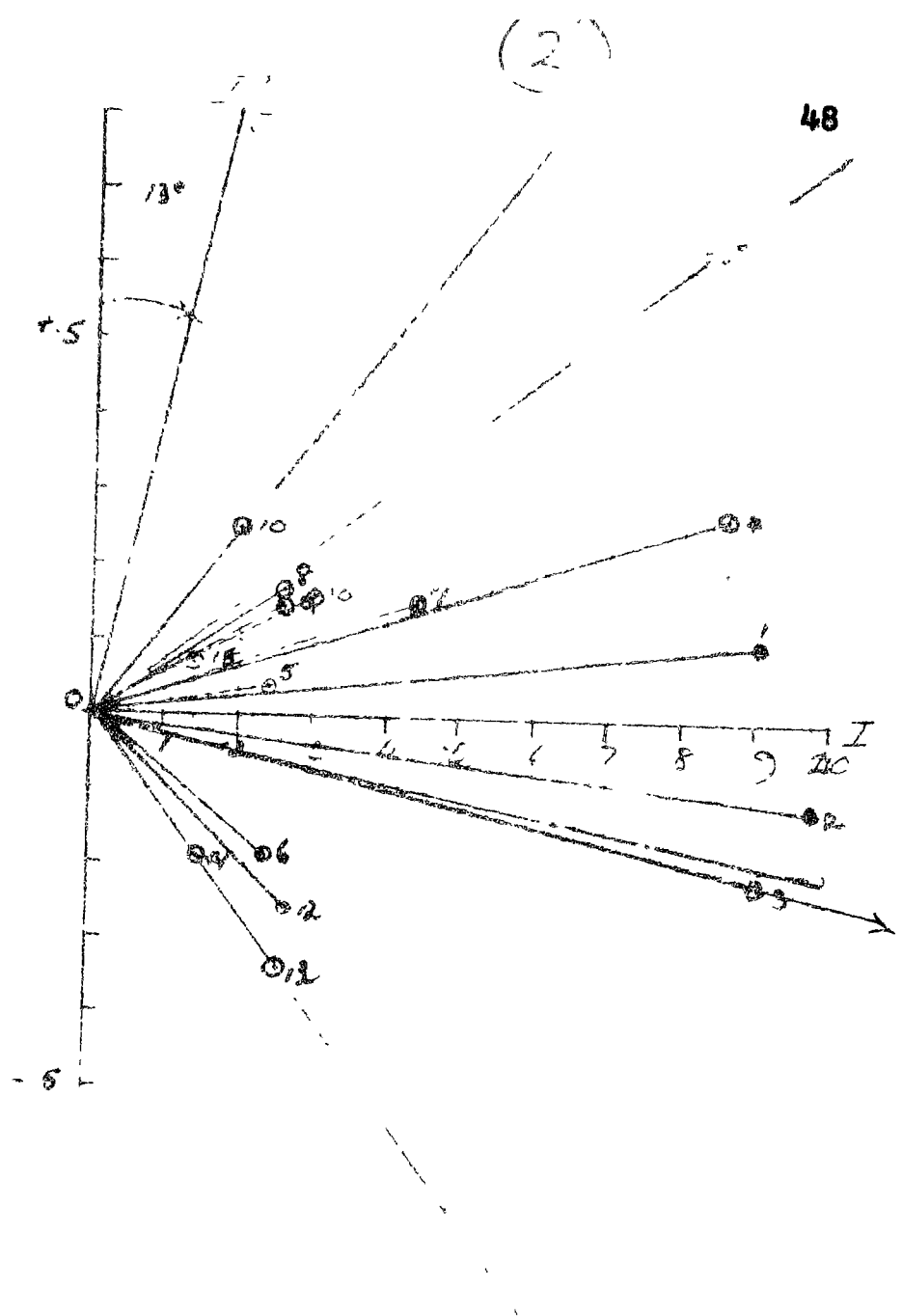
①

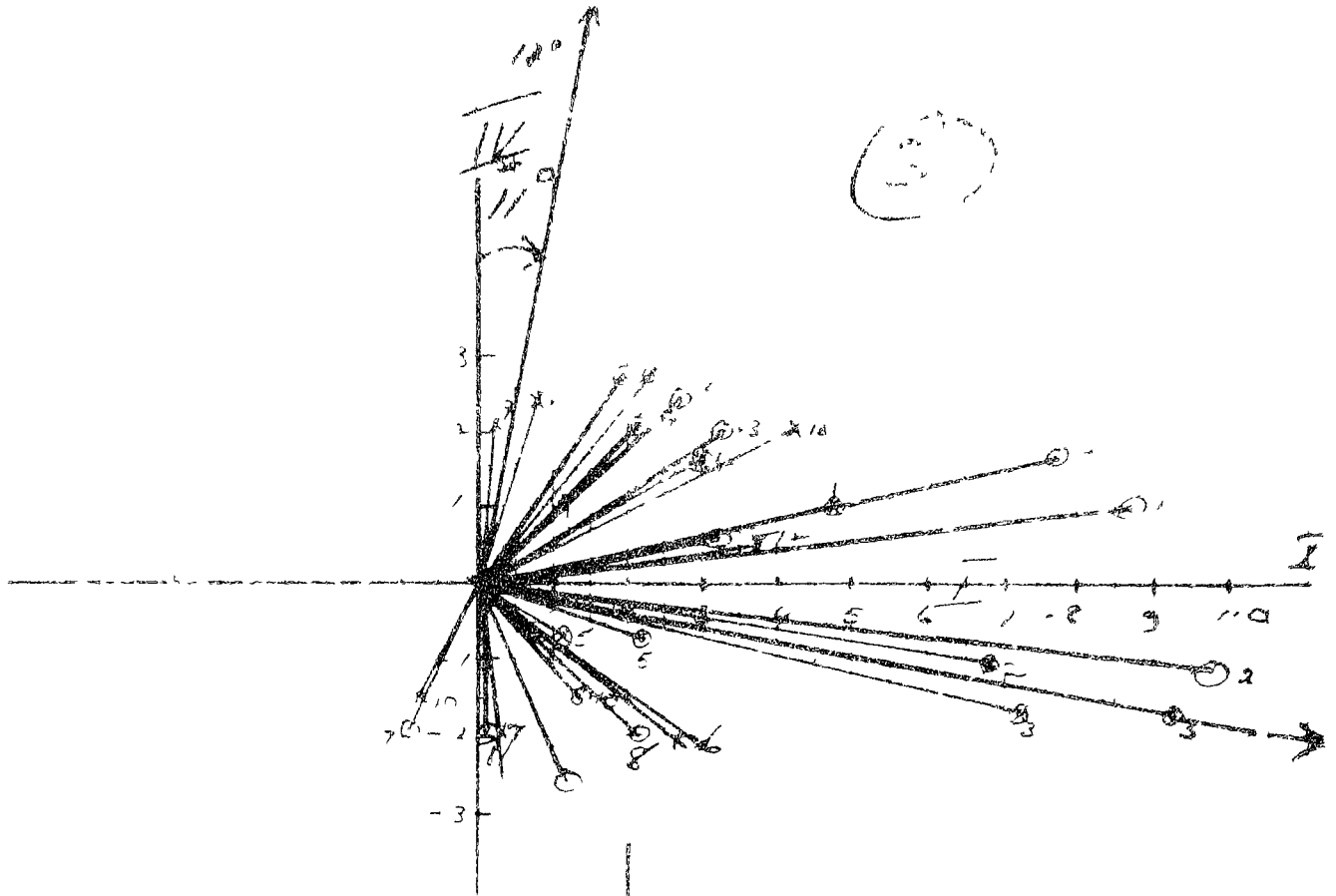
ORIGINAL DATA



ORIGINAL DATA

STATUS
AFTER
1ST ROT
(I + II)





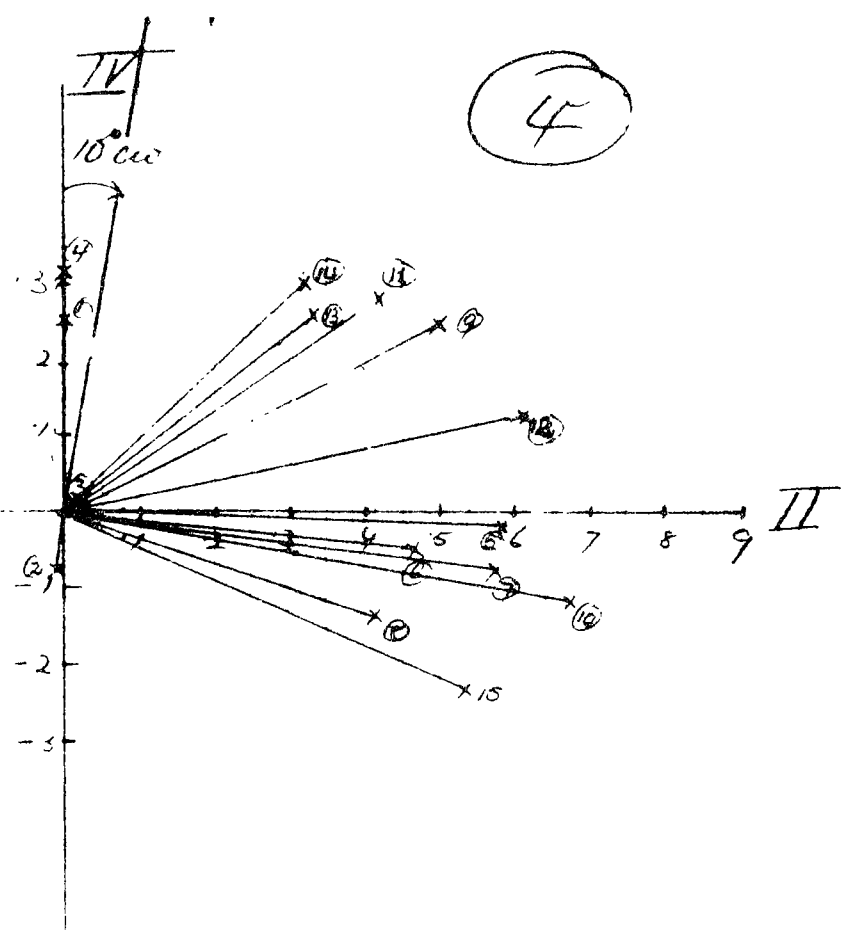
STATUS
AFTER
IXII &
IXIII (80°)
ROTATIONS
(15°
2ROT)

	1	2	3	4	1	2	3	4	
.97	.24	.30	.10	.83	.00	.30	.26	AFTER	
.95	-.01	.10	-.11	.98	-.01	.10	.08	IXI	
.93	.01	-.00	-.17	.95	.01	-.01	.01	IXII	
.77	.00	.46	.17	.73	.00	.46	.31	IXIV	
.22	.57	.01	-.07	.23	.59	.09	-.02	ROT	
.28	.46	-.13	-.21	.31	.46	-.13	-.15		
.01	.58	.15	-.19	.05	.58	.16	-.18		
.22	.41	.22	-.19	.25	.41	.22	-.14		
.22	.50	.20	.21	.18	.50	.20	.25		
.14	.1	.29	-.15	.17	.67	.29	-.12		
.26	-.1	.22	.24	.21	.41	.22	.28		
.32	.1	-.19	.06	.31	.61	-.19	.12		
.33	.34	-.17	.20	.28	.34	-.27	.26		
.19	.32	.15	.27	.13	.32	-.15	.30		
.12	.54	.10	-.26	.17	.54	.10	-.23		

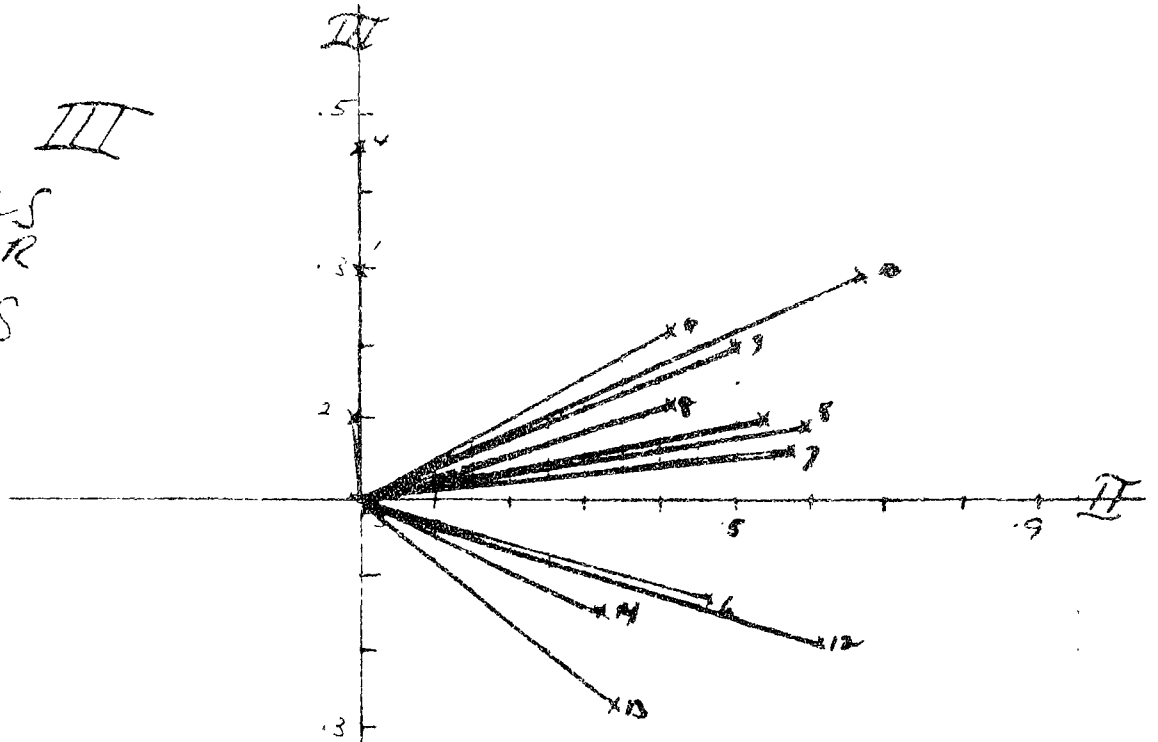
II vs IV
STATUS

AFTER

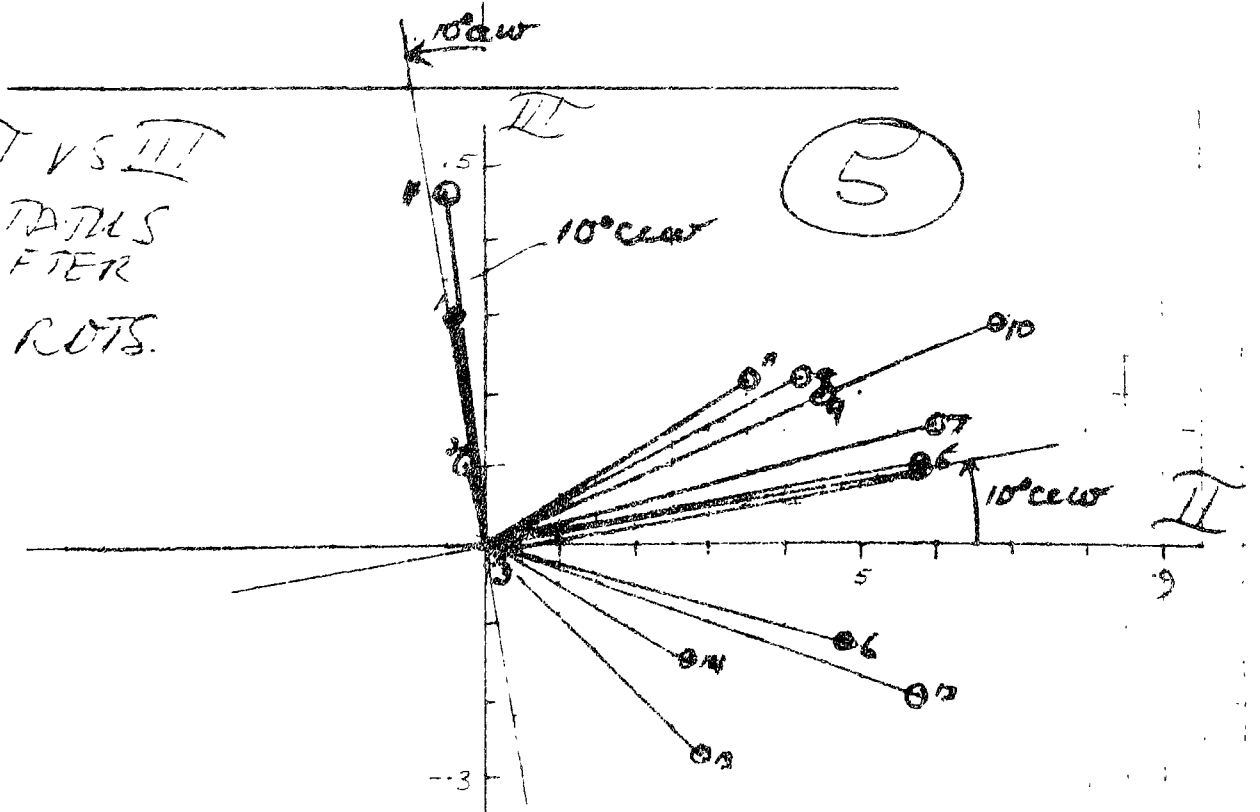
③ ROTATIONS
I x II, I x III, I x IV

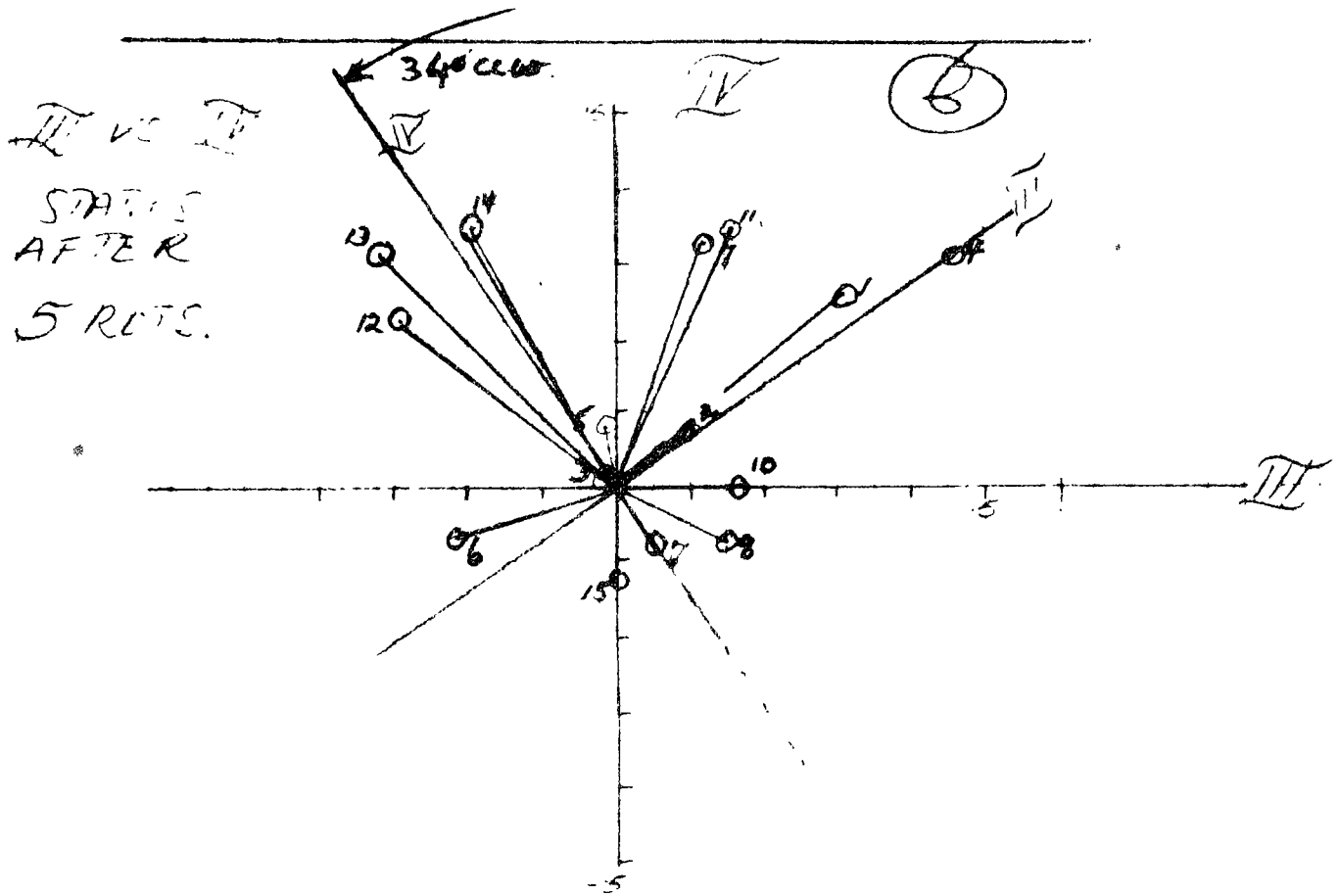


II VS III
STATALS
AFTER
③ ROTS



II VS III
STATALS
AFTER
4 ROTS.





APPENDIX 4

ABSTRACT OF

A Factor Analytic Study of the Quantitative H-T-P¹

Hypotheses have been formulated concerning the differential value of quantitative scores on the H-T-P in terms of basing qualitative appraisals on them. Although drawings rate highly in the armamentarium of the clinical psychologist, little interest has been expressed in terms of providing a quantitative and objective basis for the global, qualitative evaluations made through cursory inspections of drawing elements.

In this study, factor analytic methods were utilized in investigating the basic underlying structure of the quantitative scoring system devised for the H-T-P. This was done by analyzing a fifteen variable problem by cluster analysis and the complete centroid solution. Student nurses took all tests in the battery within a three week period. Test-retest reliability and scorer reliability were done before the actual factor analytic work.

¹ John J. Digiammo, doctoral thesis presented to the School of Psychology and Education of the University of Ottawa, Ontario, August 1962, viii-54 p.

The results point to a low but acceptable test-retest reliability and a very favorable degree of inter-scoring consistency. The results of the factor analytic procedure in general failed to support the hypotheses concerning the differential value of the quantitative scores and tends to render suspect, any qualitative appraisal based strictly on quantitative scores. A main finding was that all four scores appear to be saturated with a spatial or general overall drawing factor. A suggestion for further research was made in terms of comparing broad categories of personality characteristics based on quantitative scoring of the H-T-F with those made on the basis of a relatively objective instrument.