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THE RELATION OF PERSISTENCE TO ACADEMIC SUCCESS

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THE RELATION OF PERSISTENCE TO ACADEMIC SUCCESS

A Validation of the Seckler Maze as a Test of Persistence
and its Relation to
Academic Success in the Junior High School.

by

Edward P. Ponte

Thesis submitted for the degree of Master of Science

MASSACHUSETTS STATE COLLEGE

Amherst, Massachusetts

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INTRODUCTION

The role of persistence in determining success cannot be denied, and yet the measure of this important trait has been neglected. Today there is no reliable measure of voluntary perseveration (persistence) which is sufficiently valid in predicting success in school to warrant its acceptance. This investigation was carried out with the hope of gaining more information about this slighted trait. A test which had been devised by Seckler was used and found to be a valid measure of persistence, but the scores made on it bore no relation to academic success in the junior high school. Another test was devised by the author and administered as a persistence test, but it proved to be of no value in this investigation.

REVIEW OF THE PROBLEM

In 1894, Neisser coined the word "perseveration" and defined it as an abnormally persistent repetition of an activity, after the activity, in normal behavior, would have been completed. This could be interpreted to mean either "voluntary" or "involuntary" perseveration. Later psychologists adopted and broadened the term to include all the

various concepts which have come to be associated with, or studied under, the name of "perseveration". Perseveration has no commonly accepted meaning, but refers to all the multiform phases that have at some time or other been associated with it. To speak of perseveration without a clear cut understanding of the interpretation, as here used, would only add to the confusion already existing.

The author takes the point of view of the more recent investigators in recognizing that the topic should be subdivided into "involuntary" and "voluntary" perseveration. This terminology follows that used by Allport (1) in describing perseveration. Throughout this report all reference to involuntary perseveration will be labeled as such, and voluntary perseveration will be termed persistence. The present study dealt with the latter type of behavior.

Involuntary perseveration was the type studied by the early psychologists in which, according to Cameron (2), there was a tendency for a primary activity to persist after the subject had decided to change that activity, the primary activity being shown by a transitory interference with the secondary activity which followed it. An example of this type of perseveration, with which everyone is familiar, is a tune that keeps continually "running through the head" in spite of efforts to banish it. Early psychologists used this interpretation to avoid the controversy of "will".

Voluntary perseveration (persistence) is a significant concept, although still an unpopular one, in which the measure

is taken to be the degree to which a person consciously perseveres to complete a task. This of course immediately injects the precarious problem of "will power", the inclusion of which is not denied in this concept of perseveration, but will not be discussed as it is of no concern to the present study.

The amount of work done in the field of perseveration is comparatively small in view of the research that has been done on such topics as intelligence, aptitudes, learning, perception, and sensation. Of the many phenomena investigated, perseveration has not been accorded the attention that it warrants.

Persistence (voluntary perseveration) is universally acknowledged as one of the factors determining success. A common expression in describing an individual's success is: "His ability is not exceptional, but his determination and 'sticktoitiveness' get him places." A person of average ability frequently accomplishes more outstanding feats of achievement than another individual who is his mental superior. The latter, in many cases, has only accomplishments of mediocre caliber to record in the final chapter of his book. Persistence, determination, ambition, voluntary perseveration, or whatever term one selects to define this trait, probably contributes in no small degree to success. Herein lies the answer to the popular, but fallacious, interpretation of "genius" as measured by intelligence tests. An I Q of 140 or more does not in itself constitute genius, nor guarantee

that the achievements of one with such a high mental rating will be worthy of recognition. There are many individuals whom measurement places in the category of genius, but achievement places elsewhere. Real achievement through ability alone is a rare exception. Persistence and ability are inseparably bound together in the concept of success. Why, then, has this important factor been so neglected in study? The complexity of the problem, the confusion of terminology, and the contradictory reports of investigators constitute the answer.

We must admit that little more is known about the problem of perseveration today than when Wiersma carried out the first experimental investigation of it. Seckler (10) states, "A survey of the work reported on the problem of perseveration shows no clear cut evidence as to the nature of perseveration or the characteristics of the perseverator. The problem seems intimately related to the more general problems of success and adjustment, but the intrinsic difficulty of the investigation of these relationships make conclusions from the little work done on these aspects of the problem vague and unsatisfying." Kendig and Shevac (4, p.223) conclude, "Every experimental result is contradicated by an opposite finding. The nature, the range, and the measures of perseveration, then, remain undetermined."

In a review of past studies, three main groups of investigators may be distinguished:

1. Those who through the use of nonsense syllables and (involuntary) perseveration of words attempted to gain an insight into the chemico-neural processes of the phenomena.
2. Those who tried to discover a relation between perseveration (involuntary) and known character types such as introverts and manics.
3. Those whose investigations attempted to reveal a relation of perseveration (voluntary) to certain character traits as a variable of personality and a determinant of success.

The studies of the first group attempted to explain perseveration in terms of some inertia or lag of chemical neural processes, when relatively little is known of these same processes in simple behavior. In this group can also be placed such investigators as Rich (7) who reported indications of a relationship between perseveration and certain factors, such as acid and phosphorus in the urine. Ryans (9, p.96) states, "From the standpoint of bio-chemistry, there can be no doubt but that activity and perseveration are more than a little subject to variation and control through harmonic secretions of the endocrine glands."

Pinard (6), Cameron (2), Kendig and Shevac (4) attempted to measure perseveration by the use of such tests as the

"Inverted S" test, the "Triangle" test, the "Mirror Image" test, "Strokes" test, and the "C Word" test. These tests, most of which were administered as group tests, were very similar in nature and purported to test the same phenomena described by Cameron (2, p.736) as: "the tendency of an activity to persist after the subject has decided to change that activity, this persistence in the primary activity being shown by a transitory interference with the new activity which follows it."

Ryans (8, p360) attacked the problem from a physical persistence point of view and claimed that the trait of persistence "to be of the same nature as, and probably basically identical with, physical endurance."

Seckler (10) used a temporal stylus maze and presented problems to the subjects to be solved by simple combinations of moves around the blocks of the maze. (See Fig.I p.49) The type of behavior tested by Seckler's maze, as shown by the present study, is unquestionably a nonadjustive type of persistence, and is a good example of a test of voluntary perseveration. She found a relation between perseveration and the "neurotic tendency" as measured by the Bernreuter Personality Inventory. She reported that the individuals who persist most and those who persist least may be said to be less well adjusted than those who persist normally.

Kendig and Shevac (4, p.223) claimed results which were opposed to those reported by Seckler. They said,"If we accept Bernreuter's statement that neurotic tendency and

introversion are correlated .95, and we found no correlation between perseveration and 'neurotic tendency', we are justified in concluding that perseveration and introversion are not linked. This is opposed to Jung's theory and the conceptions of the earlier psychiatrists, but is in line with Pinard's and Jasper's more recent findings." Although these reports seemingly contradict each other, they can be better understood by reference to the differentiation between voluntary and involuntary perseveration. Seckler is speaking of voluntary perseveration, while Kendig and Shevac are reporting on involuntary perseveration. Some of the conclusions of investigators can be made less confusing by discriminating between the two types of perseveration. Only the more recent investigators have taken cognizance of this fact for the earlier studies treated perseveration as a single integrated response of the mechanism.

Pinard (6, p.10) attacked the problem of the relation between different traits of perseveration, and stated that about 75% of the most "difficult" and "unreliable" subjects proved to be extreme perseverators or extreme non-perseverators. About 75% of the most "self-controlled" and "persevering" subjects showed only a moderate degree of perseveration. Here again is encountered the dilemma of contradiction which can only be made clear through the recognition of the two distinct types of behavior. Pinard's report is interesting in that he finds that the most "persevering" (persistent) subjects showed only a moderate degree of perseveration.

This statement would indicate that he was speaking of some trait other than persistence, so this points out clearly the reason Seckler, and Kendig and Shevac reported contradictory findings. From Pinard's statement, it is clear that he found persistence and involuntary perseveration to be different phenomena; i.e., the most persistent subjects were only moderate perseverators (involuntary), thereby denoting that the extreme perseverators must have been the least persistent. Although Pinard gives no correlation ratio of this relation, it is evident that the relation must be highly negative, if we accept the veracity of Pinard's statement. Does this then explain the findings of Seckler, Kendig and Shevac? They reported on supposedly the same characteristic, but they tested traits that correlate negatively! Following this line of thought, there is every reason to accept the studies reported since different results were obtained when actually testing opposite traits.

No other definite conclusions can be drawn from a study of previous work in the field , as reports of the various investigators are conflicting and confusing.

THE PROBLEM

The problem of this investigation was (1) to determine the validity of the Seckler maze and the Ponte test as tests of persistence; and (2) to reveal the relation of these tests to academic success.

SUBJECTS AND APPARATUS

SUBJECTS:

The subjects used in this investigation were eighty-two junior high school pupils of both sexes, who ranged in age from ten years and two months to sixteen years and four months. Their I Q range was from 55 to 139. This was not a random sampling of the population of the grades represented, but a selection which included a wide range of ages and I Q's. Eighteen of the group had I Q's below 85, thirty-five had I Q's between 85 and 114, and twenty-nine had I Q's over 114. (See Fig. V, p.58 for the frequency distribution.)

APPARATUS:

The Seckler Maze:

The first test of persistence administered was the Seckler Maze test, which was devised and used by Seckler (10)

in 1932. It was a wooden temporal stylus maze the base of which was ¾" x 10½" x 12". Superimposed on this base were three rectangular frames, two small ones in the central area of a large one. Placed thus, grooves, which were used as pathways for the stylus to follow, were formed around the smaller frames. (See Fig. I, p.49). The stylus was a small pointed dowel, approximately the size and shape of a pencil.

The five problems, one a learning problem, ABA, three solvable problems, AAB, BBA, BAB, and one unsolvable problem, AB, were written on index cards 3" x 5".

The Ponte Test:

This test was devised by the author and was first used in this study. It consisted of two manipulative puzzles of geometric forms each of which was to be fitted together to form a larger figure similar to the model provided.

The first part of this test was a solvable problem which consisted of six pieces which, when fitted together, would form a square the size of the provided model which was 6" x 6". (See Fig.II, p.54). The second part, an unsolvable problem, was made up of seven pieces which would supposedly form a cross similar to the model. This cross was cut from a 6" square of wood. (See Fig.II, p.54). Actually, however, these pieces could never be put together to form a cross like the model. The amount of time spent on the latter part of the test constituted the score of "p".

PROCEDURE

The first part of the procedure was to determine how valid the Seckler and Ponte tests were as measures of persistence. The subjects selected were given the Seckler test first, and the Ponte test several days later. A rating scale was devised and used by six teachers to rate the subjects on the amount of persistence they possessed. The scores represented by the number of trials each subject took in attempting a solution of the Seckler maze will be spoken of as the "Seckler Trials". These scores were correlated with the persistence ratings and found sufficiently valid to be used as a desired measure. The Ponte test correlated too highly with intelligence, so it was not considered further in the study. To determine the relation of persistence to academic success, the honor points for each pupil were correlated with the number of trials on the Seckler test. The relation of these two functions was apparently influenced by intelligence, "seconds per trial", and ages, so it was necessary that these three functions be partialed out.

Validation of the Seckler Test. To validate the Seckler test as a measure of persistence, six teachers who were well acquainted with the subjects and their school work, were asked to rate the degree of persistence displayed by each pupil. This rating sheet (see p.12) consisted of five statements, each describing a certain degree of persistence. The teacher had merely to check the statement which in her est-

Name.....

Directions: Check the statement which best describes the degree of persistence which you feel he (she) possesses.

1. Never works very long on anything. Gives up very easily.
2. Occasionally sticks with a task until completed.
3. Nearly always completes ordinary assignments and duties within his capacity.
4. Never fails to complete ordinary assignments and tasks. Works moderately on difficult tasks, making a conscientious effort before giving up.
5. Always sticks to a task until it is finished or is convinced that it is beyond his ability.

Rated by.....

SCALE USED BY TEACHERS IN RATING THE SUBJECTS ON PERSISTENCE.

imation best described the subject. Each statement was given a weighting as to the degree of persistence. As the statements were arranged and numbered progressively, the weighting was taken as the actual number of the statement on the sheet. For example, if statement number one were checked as best describing the subject, he was rated "one" for persistence on the sheet. If statement number four were checked, he was rated "four" for that sheet. The ratings were added, and the totals were used as the "persistence rating" of the individual. There were five descriptive statements on the sheet, so the maximum "rating" would be 30, and the minimum 5. The ratings on these were correlated with the Seckler test to establish the validity of the maze as a test of persistence.

Seckler did not make any report of the validity of the test, but it was used by her as a measure of persistence because she reasoned that the person who continued longer in an attempt to find a solution to the problem, was the more persistent. She presented an unsolvable problem in order that the number of trials would constitute the score of "p". The solvable problems could not give a true measure of "p", for once the solution was found, there was no method of determining how much longer the subject might have worked in seeking a solution.

Honor Points and the Seckler Test. The number of honor points accumulated by each subject was taken as a measure of academic success. These were derived from the marks pupils received in various subjects: an "A" was given a rating of

four points, "B" three points, "C" two points, "D" one point, and "F" no points. As some of the subjects were studied by the pupils several times a week, and others only once a week, it was necessary to give proportionate value to the subjects to which more time was devoted. This was done by multiplying the number of periods per week by the point value of the mark received in the subject. For example, student A took social science two periods a week and received a mark of "C" for the term's work. A "C" has an honor point value of two, so this value multiplied by the two periods a week gave him four points for social science. This same student had English five periods a week and received a "C" in this subject also, which, valued at two points multiplied by five periods per week, gave him an honor point rating of ten for English. This procedure was followed for every subject that each pupil studied, and the total of the subject ratings was taken to represent the "honor point" rating. This mark was based on a full semester's work, from September 1938 through February 1939.

The honor point ratings were correlated with the Seckler test scores to determine the relation of academic success to persistence. This relation was apparently influenced by intelligence, "seconds per trial", and age, so it was necessary to partial out these factors. With these influences held constant, the relation sought was obtained.

The Relation of the Ponte Test to Intelligence and to the Seckler Test. The scores made on the Ponte test were

correlated first with the I Q's and then with the Seckler Trials. Due to the fact that the correlation with intelligence was higher than had been expected, and the correlation with the Seckler Trials was lower than had been expected, the test was dropped from further study. The I Q's were determined by administering the Otis Quick-Scoring Mental Ability Test, Form A, and the Terman Group Test of Mental Ability, Form A, and converting the scores to I Q's. The average of the two I Q's obtained in this manner was used as the measure of the subject's intelligence. The selection of subjects from this group was made so that the range of the I Q's would include groups of relatively low, normal, and high I Q's. The I Q's were correlated with the other variables of the investigation.

Testing Procedure. In both the Ponte and Seckler tests, the subjects were tested individually, sitting directly opposite the examiner at a table. In explaining the work to the subject, he was told that he was merely helping in the making of a "survey" and that his accomplishment would in no way affect his school marks. After the information necessary to the study was recorded, and the directions for doing the Seckler test were given in detail (See Manual of Directions p.48), the subject was allowed to proceed with the test and work as long as he chose. The problem cards were numbered and stacked in order to avoid confusion in presenting the problems. An accurate record of the number of trials and the time spent on each problem was kept by the examiner. Throughout the

test strict attention was paid to the efforts of the subject, and caution was taken not to appear indifferent, thereby suggesting that there was no solution to the last problem. The subject at no time suspected the true significance of the test, or was told that the problem was unsolvable. During the test, it was noted that some subjects contemplated each move, while others worked in a hit or miss fashion. Using the total time and the number of trials, the amount of time spent on each trial was determined. When the test was completed, the subject was asked not to divulge the nature of the survey to anyone as it might affect the results the other students obtained.

From five to ten days after taking the Seckler test, the subject was recalled and was given the Ponte puzzle test. When the subject understood what he was to do, (See Manual of Directions, p.53), he was allowed to work as long as he wished without interruption. A careful check on the time spent was made and recorded by the examiner. At no time was any clue given which hinted that the Ponte puzzle was not solvable. The examiner watched intently the manner in which the subject attempted to form a cross similar to the model. Even the subject gave up, he was asked not to discuss this test outside, either, as it might affect the other subjects' scores.

To secure a true rating of "p", it was necessary that the subject exert his maximum effort. If he had not, there would have been no indication of where he might have stopped had he been motivated to put forth his best effort. This

applies to any test of persistence or perseveration, for if the individual does not try his utmost, the test fails to give a true rating. If it claims to measure persistence, and the individual stops prematurely, the test fails in its purpose. In administering the tests, to secure maximum effort, the author offered three cash awards to those making the best scores on the battery of tests. It was felt that this incentive would motivate the subjects to put forth the desired effort. They were not enlightened, however, as to what constituted a good or bad score.

As a true persistence test does not lend itself to competitive scoring, a short "scoring" test was given. This was merely a game which consisted of dropping marbles into a box filled with holes, each counting a certain number of points. The object of the game was to get the highest possible score. So that this would not appear too simple, the subjects were asked to keep and total their scores mentally. The examiner recorded these scores on a card provided for that purpose. When the battery of tests was completed, the prizes were actually awarded for the highest totals made on this "scoring" test. The true motive of this test was not revealed at any time. The subjects were led to believe that the prizes were won by those who got the highest scores on the battery of tests.

RESULTS.

The averages, average deviations, and the standard deviations of the following are presented on page 22: Ages, Honor Points, Intelligence, Persistence, Ponte Test, Seckler Test, "seconds per trial", and Seckler Time. The correlations and probable errors of the functions are tabulated on pages 23-25.

Seckler Test.

It is interesting to note (See Fig. IX, p.62) that one subject averaged one second per trial and made only two attempts, and that another took one hundred twenty-eight seconds per trial for four attempts. These attempts constituted the range of the "seconds per trial" scores. This factor seemed important enough to be taken into consideration in the final results by holding it constant by the partial correlation technique. This technique follows the methods set forth by Yule (12) and Garrett (3). Throughout the remainder of this study, the number of seconds used by a subject for each trial will be referred to as the "seconds per trial" score.

The SD (standard deviation) of the "seconds per trial" scores was found to be 21.20, and the average was 23.78. This in itself indicates the degree to which the subjects varied in the amount of time taken for each trial. In correlating the results of the Seckler test with other measures, the influence of this time factor was eliminated by partial cor-

relation, whereby the time factor was held constant.

The range of the Seckler Trials was from 2 to 505, with a SD of 81.09, and an average of 64.09. As there was a congestion of scores at the lower end of the range giving the distribution positive skewness (See Fig. VIII, p.61), it made necessary the use of a small step interval in treating the results, despite the range, to avoid having too large frequencies in some steps, contrasted to low frequencies in adjacent steps. With so small a step interval, many had frequencies of zero, so to make the diagrams of more convenient size, the step intervals of zero frequencies were omitted. Care must be taken in interpreting results from the diagrams as the appearances are apt to be misleading because of the altered shape and size. For example, in Fig. VIII, page 61, the step interval 504-507, appears to be only twenty deviations from the guessed average, 62, but is in reality 112 deviations above it.

The Seckler Time (i.e., the total time spent by the subject on the problem) had a range of from less than one minute to 76 minutes, with a SD of 17.87, and an average of 17.2 minutes. Of the time scores, the "seconds per trial" scores were considered the more important and were used throughout the study in the elimination of the time influence.

The Seckler Time correlation with the Seckler Trials resulted in an r of .71 and a PE of .04. This result was predictable because it is evident that the greater the

number of trials taken, the longer the total time spent.

Ponte Test:

When this test was devised by the author and used in the battery given to the subjects, he believed that it tested the same trait as Seckler's test and would prove analagous to it in its measurement of persistence. Statistical treatment of the results indicated that this belief was wrong. The time range of the test was from 6 to 155 minutes, with a SD of 35.40, and an average of 63.17. The correlation between the Ponte test and Seckler Time was .08 with a PE of .07, which indicated the lack of relation between the two tests. To confirm this, the non-linear relation between the two tests was calculated and found to be -.10. The test was also correlated with the IQ's of the subjects which gave a result of .57 with a PE of .05. One point upon which previous investigators of perseveration agreed was that there was no relation between perseverative tendency and intelligence. As this investigation was made to study the relation of persistence to school success, the Ponte test was dropped from further study because of its close relationship to intelligence, (as the results disclosed), and its lack of analogy to the Seckler test.

The author believes that this unpredicted correlation of the Ponte test with intelligence can be attributed to the fact that those subjects with intelligence above average were motivated to a greater degree by their past success with game puzzles which resemble the Ponte puzzle. They

persevered longer than the subjects below average whose past experiences had taught them to expect little or no success in such undertakings. Because of these previous experiences, the higher the I Q, the more determined the subject was that he could master the problem, and on meeting unexpected failure, he was still willing to persist in finding a solution. Those with lower I Q's, however, after working for a short time and failing, were ready to admit defeat.

Because the results of this test proved contrary to what had been expected, the statistical treatment of the test was concluded here as it had proved to be of no value in this investigation.

The Persistence Scores ranged from 7 to 28, with a SD of 4.99, and an average of 17.24.

The I Q's ranged from 57 to 136, with a SD of 18.27, and an average of 102.3. It is interesting to note how close the obtained average was to the true average, as the subjects did not represent a random sampling.

The Honor Points ranged from 17 to 116, with an average of 76.40, and a SD of 20.08.

THE AVERAGE, AVERAGE DEVIATION AND THE STANDARD DEVIATION OF THE VARIABLES STUDIED.

Variable	Average	Average Deviation	Standard Deviation
Ages	13yr. 5mo.	11 mo.	14.9 mo.
Honor Points	76.40	15.47	20.08
Intelligence	102.3	15.95	18.27
Persistence	17.24	3.98	4.99
Ponte Test	63.17	29.88	35.40
Seckler Trials	64.09	57.09	81.09
"seconds per trial"	23.78	13.27	21.20
Seckler Time	17.20	13.97	17.87

TABLE I

RESULTS OF VARIOUS SCORES CORRELATED WITH SECKLER TRIALS:

	r	PE_r
Persistence	.69	.04
Ponte Test	.08	.07
Seckler Time	.71	.04
Honor Points	.23	.07
Intelligence	.09	.07
"seconds per trial"	-.22	.07
Age	-.31	.07

TABLE II

RESULTS OF VARIOUS SCORES CORRELATED WITH THE PONTE TEST

	r	PE_r
Seckler Trials	.08	.07
Intelligence	.57	.05

The non-linear relation of the Ponte test to the Seckler Trials was computed to be -.10.

TABLE III

RESULTS OF VARIOUS SCORES CORRELATED WITH HONOR POINTS.

	r	PE_r
Persistence	.53	.05
Seckler Trials	.23	.07
Intelligence	.48	.06
"seconds per trial"	.13	.07
Ages	-.46	.06

TABLE IV

RESULTS OF VARIOUS SCORES CORRELATED WITH INTELLIGENCE.

	r	PE_r
Ponte Test	.57	.05
Honor Points	.48	.06
Seckler Trials	.09	.07
"seconds per trial"	.19	.07
Ages	-.66	.04

TABLE V

RESULTS OF VARIOUS SCORES CORRELATED WITH PERSISTENCE

	r	PE_r
Honor Points	.53	.05
Seckler Trials	.69	.04
"seconds per trial"	-.24	.07

TABLE VI

RESULTS OF VARIOUS SCORES CORRELATED WITH AGES.

	r	PE_r
Honor Points	-.46	.06
Seckler Trials	-.31	.07
Intelligence	-.66	.04
"seconds per trial"	.02	.07

TABLE VII

DISCUSSION OF RESULTS

Seckler Test:

Relation to Persistence: As Seckler presented no evidence of the validation of her maze as a test of persistence, one of the important phases of this study was to investigate the validity of the test. The correlation between the persistence ratings and the Seckler Trials was .69 with a PE of .04, which indicates that Seckler's test is a relatively valid measure of some type of persistence. The question might be raised as to why the "r" was not even higher. It should be remembered that in securing the validation , the author used the time-worn method of teachers' ratings. We will not enter into a controversy over the reliability of such ratings, but in questioning the accuracy of the .69 as a "true" measure of the relation, it should be borne in mind that teachers' ratings are not altogether accurate. We realize that if each teacher's estimate of a subject's persistence had been perfect, the ratings would all have been alike. Actually, however, some students were rated low on persistence by some teachers, and high by others. This discrepancy proves the flexibility of teachers' ratings. We realize that some individuals are very persistent in one thing and not persistent at all in another. Therefore, a subject might have been very persistent in his Latin class and extremely nonpersistent in his algebra class. Interests, environment, attitude toward the instructor, and various other causes may contribute

to this inconsistency.

The effect of these undetermined influences on the persistence ratings may work either for or against a higher correlation. Their effect cannot be determined until some method of measuring them has been devised. The author believes that such measurement of these influences would raise the value of the Seckler test as a measure of persistence. As no method of holding these influences constant was available, the correlation of .69 was accepted and used throughout the remainder of the study. With a correlation which is greater than seventeen times the PE, its reliability is well established.

Relation to Intelligence: One point on which all investigators agree is that both involuntary perseveration and persistence do not correlate with intelligence to any degree. A person's intelligence is no index of his persistence. The Seckler Trials, correlated with the I Q's of the subjects, gave a result of .09, with a PE of .07. This correlation was in accord with the results of previous investigators.

Relation to Ponte Test: The lack of relation between the Seckler and the Ponte tests has already been discussed. This correlation was .08, with a PE of .07, which was a definite indication that the Ponte test did not test the same trait as did Seckler's test. The correlation of the Ponte test with I Q's was .57, with a PE of .05, disclosing further that it was not a test of persistence.

Relation to Ages: The Seckler test correlated with chronological age gave an "r" of -.31. Briefly, this indicated that the older pupils were the least persistent. This correlation had to be calculated as it was one of the variables of the problem.

Relation to Honor Points: Of major interest in this study was the relation of the Seckler Trials to Honor Points, which was .23, with a PE of .07. In view of the important role that persistence probably plays in determining success, the relation represented a product-moment correlation and could not be accepted as a true relation of the two factors because the other variables might have had an influence on the result. The influence of these other variables (seconds per trial, intelligence, and ages) had to be reckoned with before a reliable relation could be established. The relation of the number of "seconds per trial" to the number of trials was mentioned previously. This influence was recognized and partialed out. No one questions the fact that intelligence plays an important part in an individual's success. The relation between intelligence and success in the junior high school was .48. The role of intelligence in success must also be considered when drawing any conclusions about success in relation to persistence. Moreover, the ages of pupils in the junior high school influence their success and bear a definite relation to their intelligence. These factors are so closely related that unless consideration is given to all of them, the interpretation will be incorrect. The partial

correlation technique was used to eliminate the influence of these factors on the final result. As this investigation was a study of the relation between the Seckler Trials and Honor Points, the relation could not be accepted without partialing out the effects of intelligence, age, and "seconds per trial". The partial correlation orders in holding each successive variable constant are presented on page 35. The lengthy mathematical procedures, and the results of the various intermediate orders are omitted. The formulas and results are presented on pages 36-39.

The partialing out of the other variables had reduced the relation of the Seckler Trials to Honor Points from .23 to .14. (See p.39). A relation of .14 is of negligible value, especially in view of a PE of .11. We conclude from this result that the type of persistence measured by the Seckler test bears no relation to the academic success of the pupils in the seventh and eighth grades.

From the results of this investigation, either of two conclusions can be drawn: that the trait of persistence is not a factor influencing school success, or that the Seckler test is not comprehensive enough to be a criterion of persistence. The author believes that the latter is the more likely. The Seckler test is inadequate as a measure of the type of persistence that is a variable of school success. The measurement of persistence will have to be by means of a comprehensive test which measures the range and variability of individual persistence. The Seckler test, without doubt, tests

persistence, but persistence of a specific nature. We recognize the variability of persistence in ourselves, and realize that in certain activities we persist more than in others, and in any activity, we persist more at one time than another. If we were persistent in the type of activity measured by the Seckler test, we would be rated as high perseverators. Limiting the test to one activity evidently presents only a phase of the true picture. The Seckler test measures the persistence of the subject in that particular activity, but gives no indication of his persistence in varied fields of endeavor.

The correlation of Persistence Ratings to Honor Points was .53, with a PE of .05. This gave further evidence of the part that persistence plays in school success.

CONCLUSIONS

From the results of this investigation, and a discussion of them, the following conclusions are made:

1. The validity of the Seckler maze as a test of a phase of persistence is ascertained by the correlation of .69. The correlation (.57) of the Ponte test with Intelligence discloses that it is not a test of persistence.

2. Persistence, as measured by the Seckler test, is not related to academic success in the seventh and eighth grades of the junior high school.

SUMMARY

This investigation was conducted to determine the validity of the Seckler maze test as a measure of persistence, and to determine the relation of the Seckler test scores to academic success in the seventh and eighth grades.

The Seckler maze was proven to be a measure of persistence by correlating the scores made with the ratings of persistence made by the subjects' school teachers. Six teachers rated each subject on persistence, and the correlation of these ratings with the Seckler Trials was .69. Accepting the validity of the teachers' ratings, the Seckler maze can be considered a valid measure of persistence.

To determine the relation of the Seckler maze to academic success, it was necessary to eliminate the influence of intelligence, age, and the number of seconds taken per trial. The intelligence of each subject was derived by averaging two tests of mental ability: the Otis Quick-Scoring and the Terman Group Tests. The "seconds per trial" were computed

from the total time taken on the test. With these scores, partial correlations involving the five variables were used in order to eliminate the influence of the undesirable factors. This changed the relation of the Seckler scores to academic success to .14.

The Ponte test was administered several days after the Seckler test. At the time, it was believed that this test was also a test of persistence analogous to Seckler's test, but as its correlation with Intelligence was .57, and with the Seckler test .08, it was dropped from further study.

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PARTIAL CORRELATIONS

To find the relation between 1. Honor Points and 2. Seckler Trials partialing out the influences of 3. Intelligence, 4. "sec. per trial" and 5. Age.

In the formulae used on the succeeding pages the numerical sub-scripts are used to denote the following measures:

1. Honor Points
2. Seckler Trials
3. Intelligence (IQ)
4. "sec. per trial"
5. Age

The results of the correlations were as follows:

$r_{12.3} = .21$ $r_{12.34} = .21$ $r_{12.345} = .14$

$r_{14.3} = .05$ $r_{15.34} = -.24$

$r_{15.3} = -.22$ $r_{25.34} = -.35$

$r_{24.3} = .001$

$r_{25.3} = -.34$

$r_{54.3} = .21$

$$r_{12.3} = \frac{r_{12} - r_{13}r_{23}}{\sqrt{1-r^2_{13}}\sqrt{1-r^2_{23}}}$$

$$= \frac{.23 - (.48)(.09)}{(.8773)(.9959)}$$

$$= \frac{.1868}{.8737} = .214$$

$$= .21$$

$$r_{14.3} = \frac{r_{14} - r_{13}r_{43}}{\sqrt{1-r^2_{13}}\sqrt{1-r^2_{43}}}$$

$$= \frac{.13 - (.48)(.19)}{(.8773)(.9818)}$$

$$= \frac{.0388}{.8613} = .045$$

$$= .05$$

$$r_{15.3} = \frac{r_{15} - r_{13}r_{53}}{\sqrt{1-r^2_{13}}\sqrt{1-r^2_{53}}}$$

$$= \frac{-.46 - (.48)(-.66)}{(.8773)(.7513)}$$

$$= \frac{-.1432}{.6591} = -.217$$

$$= -.22$$

$$r_{24.3} = \frac{r_{24} - r_{23}r_{34}}{\sqrt{1-r^2_{23}}\sqrt{1-r^2_{34}}}$$

$$= \frac{-.22 -(.09)(.19)}{(.9959)\ (.9818)}$$

$$= \frac{.003762}{.9778} = .004$$

$$= .00$$

$$r_{25.3} = \frac{r_{25} - r_{23}r_{35}}{\sqrt{1-r^2_{23}}\sqrt{1-r^2_{35}}}$$

$$= \frac{-.31 -(.09)(-.66)}{(.9959)\ (.7513)}$$

$$= \frac{-.2506}{.7482} = -.335$$

$$= -.34$$

$$r_{45.3} = \frac{r_{45} - r_{34}r_{35}}{\sqrt{1-r^2_{34}}\sqrt{1-r^2_{35}}}$$

$$= \frac{.02 - (.19)(-.66)}{(.9818)\ (.7513)}$$

$$= \frac{.1454}{.7093} = .205$$

$$= .21$$

$$r_{12.34} = \frac{r_{12.3} - r_{14.3}r_{24.3}}{\sqrt{1-r^2_{14.3}}\sqrt{1-r^2_{24.3}}}$$

$$= \frac{.21 - (.05)(.001)}{(.9987)(1.0)}$$

$$= \frac{.2095}{.9987} = .209$$

$$= .21$$

$$r_{15.34} = \frac{r_{15.3} - r_{14.3}r_{54.3}}{\sqrt{1-r^2_{14.3}}\sqrt{1-r^2_{54.3}}}$$

$$= \frac{-.22 - (.05)(.21)}{(.9987)(.9777)}$$

$$= \frac{-.2305}{.9764} = -.235$$

$$= -.24$$

$$r_{25.34} = \frac{r_{25.3} - r_{24.3}\, r_{45.3}}{\sqrt{1-r^2_{23.4}}\sqrt{1-r^2_{45.3}}}$$

$$= \frac{-.34 - (.001)(.21)}{(1.00)\quad(.977)}$$

$$= \frac{-.34021}{(.9777)} = -.348$$

$$= -.35$$

$$r_{12.345} = \frac{r_{12.34} - r_{15.34}\, r_{25.34}}{\sqrt{1-r^2_{15.34}}\sqrt{1-r^2_{25.34}}}$$

$$= \frac{.21 - (-.24)(-.35)}{(.9708)(.9367)}$$

$$= \frac{.1260}{.9093} = .138$$

$$= .14$$

$$PE_{r_{12.345}} = \frac{.9804}{9.055}$$

$$= .108$$

$$= .11$$

PUPILS AND RATINGS

Name	Age Yrs., mo.	I Q	Honor Points	Persistence Rating
Virginia Alessi	12-5	100	94	17
Philip Babineau	15-2	106	55	7
Mary Balestri	11-11	94	80	17
Paul Bishropic	16-2	68	69	16
Jane Blossom.....	13-3	136	116	18
Charlene Boyd	12-4	121	85	20
Norma Brinker	12-11	128	92	12
Shirley Camp	12-5	97	71	15
Richard Carduff	12-1	95	61	18
Wendell Carduff	13-0	123	73	15
Concetta Casiello	12-3	105	84	16
William Cassidy	12-11	92	66	14
Jacqueline Cizek	12-6	120	106	26
Catherine Cline	11-5	125	96	20
Florence Cloudman.....	13-2	116	100	18
Susan Cross	11-10	114	89	24
John Curlin	14-5	87	67	13
Yolanda Dascanio	12-7	93	74	17
Donato Davilli	15-1	75	53	10
Dorothy Davis	13-8	73	35	17
Alfred Desrosiers	12-7	107	100	21
Helen Drobot	14-10	67	61	21
Muriel Edgerton	12-9	98	80	22
Archie Eggleston	13-10	103	84	23

PUPILS AND RATINGS (Con'd)

Name	Age Yrs., mo.	I Q	Honor Points	Persistence Rating
Raymond Eggleston.....	15-0	77	72	16
Mary Fento	12-4	97	72	16
Raymond Ferrare	14-7	87	59	17
Benjamin Fish	13-9	96	57	17
William Fleming	13-2	117	38	9
Alfred Foisey	15-3	78	80	15
Robert Foisey	13-8	103	84	23
Gerald Forni	12-6	100	49	14
William Fox	13-7	117	91	12
Barbara Fradet	10-10	108	87	26
Fred Fuda	13-11	81	18	13
James Gagnon	13-2	118	73	20
Ruth Garrett	12-8	119	104	17
Larry Germaine	13-8	126	55	10
Charles Ghedi	13-4	115	50	11
Mary Gillman	13-3	117	87	17
Beverly Gray	12-11	118	102	24
Warren Green	13-0	120	102	21
Richard Guidette	13-0	99	67	16
Enis Della Guistina	12-10	93	77	15
Harriet Hammond	12-7	114	96	22
Willis Hart	13-1	130	54	10
Jean Healy	11-9	105	90	23
Richard Hibbard	12-6	115	79	18

PUPILS AND RATINGS (Con'd)

Name	Age Yrs., mo.	I Q	Honor Points	Persistence Rating
Milton Howe	11-10	116	100	25
Robert Huckins	12-1	119	99	26
Rollin Hurd	13-6	101	86	10
Robert Keating	12-3	120	91	14
John Leahy	11-6	108	81	17
Henry Ledger	15-9	70	75	10
Arthur Lonzo	13-6	99	78	12
Marie Loquercia	13-9	93	77	15
Edmund Mandeville	15-7	76	42	17
John Millett	11-11	85	85	15
George Moultrop	13-6	130	60	7
Bruce Nagler	12-7	115	83	20
William Naliwka	15-2	92	73	17
Henry Nedweski	13-9	69	83	16
Elliot Penniman	13-1	131	42	8
Edward Pepyne	12-0	127	101	23
Dorothy Pomeroy	12-0	95	71	18
Mary Pugliano	13-8	76	71	18
Norma Rillovich	14-11	83	88	28
Carmella Riono	14-11	73	61	11
Shirley Roberts	12-2	121	90	17
James Scheering	13-3	128	80	8
Pietro Silvano	15-10	75	83	15
Walton Smith	12-11	125	65	14

PUPILS AND RATINGS (Cont.)

Name	Age Yrs., mo.	I Q	Honor Points	Persistence Rating
Alice Starzyk	12-0	103	77	24
Henry St. Dennis	16-4	57	17	15
Levi Swift	14-2	78	74	15
Jane Taylor	13-3	116	109	20
Raymond Theilig	13-1	93	74	13
Francis Topor	12-10	101	110	27
Alfred Touchette	13-0	96	63	23
Louise Tremboli	11-5	103	78	15
Angelina Tremboli	16-2	70	47	8
Jane Zelinski	15-5	71	67	14

PUPILS AND RATINGS

Name	Seckler Trials	Seckler Time (min.)	Seckler "sec. per trial"	Ponte Puzzle
Virginia Alessi	24	6	15	29
Philip Babiniau	2	1-	1	53
Mary Balestri	24	6	14	100
Paul Bishopric	17	4	14	32
Jane Blossom	32	15	28	87
Charlene Boyd	225	30	8	122
Norma Brinker	9	5	31	86
Shirley Camp	49	16	19	103
Richard Carduff	145	40	16	44
Wendell Carduff	23	18	47	75
Concetta Casiello	69	27	23	74
William Cassidy	12	3	17	29
Jacqueline Cizek	162	76	43	114
Catherine Cline	86	31	21	109
Florence Cloudman	14	3	12	34
Susan Cross	98	61	37	68
John Curlin	18	4	13	35
Yolanda Dascanio	35	12	20	98
Donato Davilli	5	1	14	25
Dorothy Davis	71	22	19	8
Alfred Desrosiers	21	7	13	35
Helen Drobot	89	7	3	80
Muriel Edgerton	205	60	17	99

PUPILS AND RATINGS (Con'd)

Name	Seckler Trials	Seckler Time (min.)	Seckler "sec. per trial"	Ponte Puzzle
Archie Eggleston	260	34	7	80
Raymond Eggleston.....	32	5	8	28
Mary Fento	32	4	7	22
Raymond Ferrare	39	6	6	17
Benjamin Fish	77	16	12	34
William Fleming	5	1-	11	79
Alfred Foisey	10	3	20	25
Robert Foisey	165	46	16	51
Gerald Forni	26	4	9	35
William Fox	12	3	13	81
Barbara Fradet	195	34	10	67
Fred Fuda	41	13	19	45
James Gagnon	119	14	6	146
Ruth Garrett	70	33	28	41
Larry Germaine	12	4	20	155
Charles Ghedi	17	5	16	47
Mary Gillman	22	23	62	142
Beverly Gray	164	74	27	50
Warren Green	30	8	15	39
Richard Guidette	53	16	17	34
Enis Della Guistina	16	13	48	55
Harriet Hammond	80	30	22	13
Willis Hart	4	2	30	55

PUPILS AND RATINGS (Con'd)

Name	Seckler Trials	Seckler Time (min.)	Seckler "sec. per trial"	Ponte Puzzle
Jean Healy	139	32	13	44
Richard Hibbard	21	18	50	93
Milton Howe	77	9	7	47
Robert Huckins	131	66	30	16
Rollin Hurd	5	1	12	41
Robert Keating	19	6	18	81
John Leahy	35	12	20	61
Henry Ledger	5	10	120	27
Arthur Lonzo	6	3	30	87
Marie Loquercia	21	5	13	29
Edmund Mandeville	41	5	6	50
John Millett	11	4	23	58
George Moultrop	8	9	67	154
Bruce Nagler	13	7	32	85
William Naliwka	9	4	23	56
Henry Nedweski	10	3	19	6
Elliot Penniman	9	6	40	71
Edward Pepyne	220	43	11	93
Dorothy Pomeroy	56	22	23	33
Mary Pugliano	20	7	19	10
Norma Rillovich	230	48	12	78
Carmella Rioni	3	1	13	25
Shirley Roberts	28	7	14	43

PUPILS AND RATINGS (Con'd)

Name	Seckler Trials	Seckler Time (min.)	Seckler "sec. per trial"	Ponte Puzzle
James Scheering	4	9	128	116
Pietro Silvano	10	12	69	52
Walton Smith	41	16	23	146
Alice Starzyk	505	48	5	47
Henry St. Dennis	55	10	10	27
Levi Swift	3	1	25	106
Jane Taylor	19	20	61	28
Raymond Theilig	16	4	13	71
Francis Topor	195	41	12	45
Alfred Touchette	104	42	24	54
Louise Tremboli	24	7	16	59
Angelina Tremboli	4	1	15	69
Jane Zelinski	9	3	18	46

MANUAL OF DIRECTIONS

THE SECKLER TEST

MATERIALS:

Seckler maze

Problem cards

Record blanks

Stylus

Watch (with second hand)

The Seckler Maze is a temporal stylus maze consisting of two oblongs with a path around each. Each oblong is lettered A and B respectively.

The Problem Cards are index size (three by five inches) with one inch letters corresponding to the problems of the test. A number is on the back of the card denoting the number of the problem so as to avoid confusion in the presentation of the problems.

The Record Blank includes information necessary to the study, such as: name, grade, s x, I Q, etc. On this a place is provided to keep a record of the number of trials on each problem.

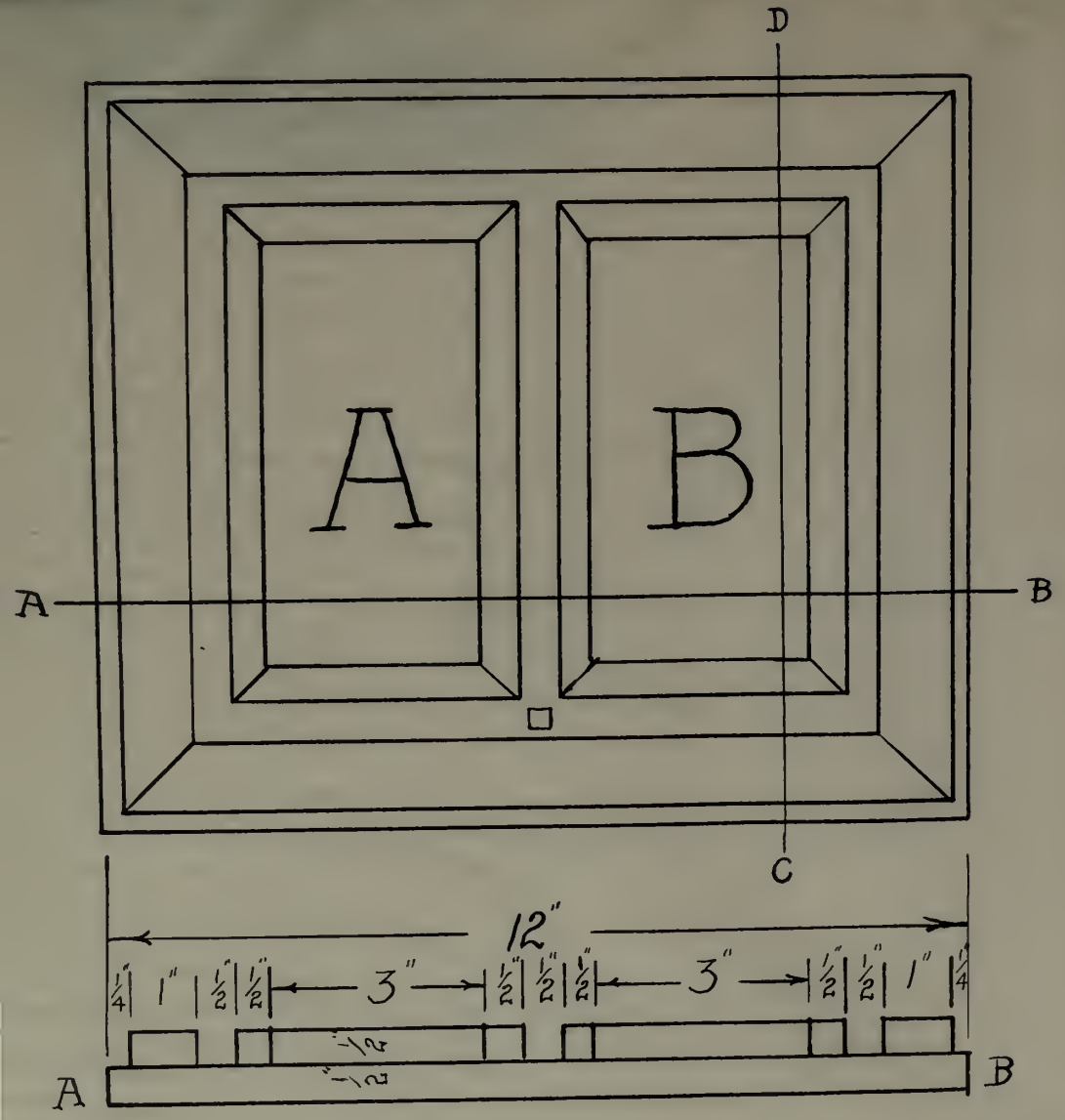
ADMINISTRATION OF THE TEST:

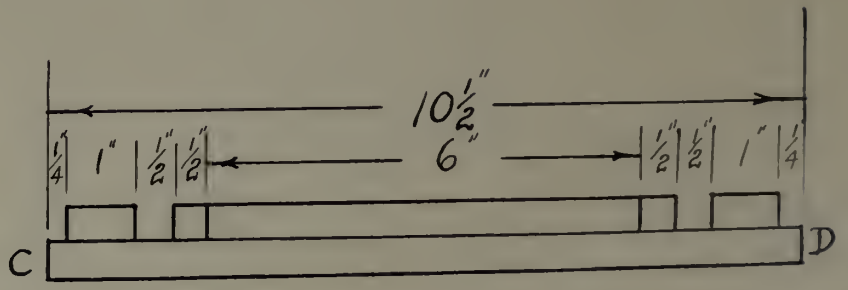
Seat the subject opposite you at a table.

Place the maze on the table in front of the subject.

Place the problem cards on the table just beyond the maze.

SECKLER MAZE





They are stacked in order so that problem number one is on top, and problem number five is at the bottom. This helps to avoid any confusion in the presenting of the problems.

Say to the subject:

"Before you is a maze, which is a kind of puzzle, consisting of two oblongs, one of which has a letter A in the middle, and the other a letter B in the middle. On these cards (show problem cards) are different arrangements of these two letters. You are to take this stylus and trace around each oblong separately in the order in which they appear on the card. Always start at the little white square, but you do not have to finish there unless you want to do so. Be sure to lift up the stylus at the end of each trial. What you will try to find is the shortest possible way to go around these two oblongs. When you find the shortest possible route, I'll say, 'Perfect goal.' If you do not travel the shortest possible route, I'll say only, 'Goal.' You may try as many times as you wish to get 'Perfect goal', and you may stop whenever you like."

"For example, this card has ABA on it (point to the card) so you go around the A block, then around the B block, and once more around the A block. If you take the shortest possible route, I'll say 'Perfect goal! Otherwise I'll say only 'Goal', and you may try as many times as you like to get a 'Perfect goal.'"

"Have you any questions to ask before we start? You will ask none after we begin."

"Ready, begin."

GENERAL INSTRUCTIONS TO THE EXAMINER:

Have the problem cards previously arranged in their respective positions ready to uncover after the completion of each problem.

Pay strict attention to the trials of the subject as a show of inattention will influence the subject.

Keep an accurate record of the number of trials made, and the amount of time spent on each problem. Keep the time in minutes and seconds.

When the subject has made several attempts at each of the first four problems, say "Perfect goal" regardless of the route taken.

The subject must not be allowed to make "Perfect goal" on the fifth problem (AB). After each trial say "Goal" regardless of the route followed. Continue this procedure until the subject gives up.

The order in which the problems are presented is: first, the learning problem, ABA; then the three solvable problems, AAB, BBA, BAB; and last, the unsolvable problem, AB.

At no time should the subject suspect the true significance of the test, or be told that the last problem is an unsolvable one. Even after he has completed the test, he should not be enlightened as it might affect the results other subjects obtain.

SCORING:

The raw score on the test is the number of attempts made by the subjects to attain "Perfect goal" in the fifth (last) problem.

PONTE PUZZLE TEST

MATERIALS:

Square puzzle

Cross puzzle

Watch

Record blank

The Square Puzzle. This puzzle is similar to a jig-saw puzzle, the object being to fit segmented parts together to form a larger figure. These pieces, when placed correctly, will form a square the same size as the model that is provided.

The Cross Puzzle. This is a puzzle similar to the square puzzle except that these parts are supposed to fit together to form a cross the size and shape of the model. In reality, however, the segments could never be fitted together to make a cross.

The Record Blank. This includes such information as is necessary to the study, such as: name, grade, sex, etc.

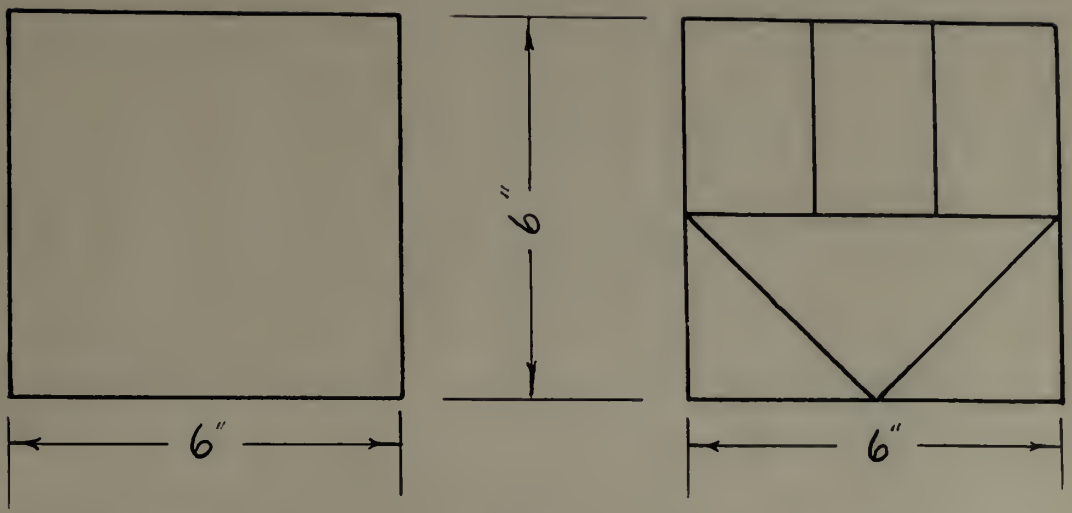
ADMINISTRATION OF THE PONTE PUZZLE TEST:

Seat the subject opposite you at a table.

Place the "square" model before the subject; then place the pieces of the "square" before him and say:

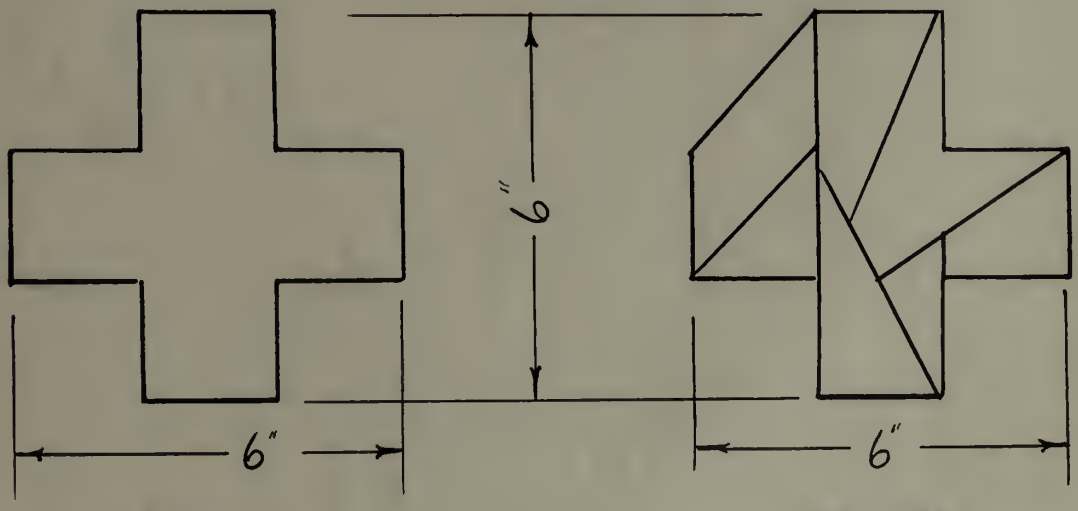
FORM PUZZLE TEST

Square Test



Model Segmented

Cross Test



Model Segmented

FIGURE II

"You are to place these pieces so that they will form a figure the exact size and shape of this model. You may work as long as you wish, and you may stop whenever you want. Are there any questions ? You will not ask any after you begin. All right, you may start."

Have a watch on the table so that the exact time taken to complete the puzzle successfully can be recorded.

When the first puzzle has been completed, place the "cross" model and the corresponding pieces before the subject, and say: "You are to place these pieces so that they will form a figure the exact size and shape of this cross. You may work as long as you wish. You are to ask no questions after you begin. All right, begin."

Record the exact amount of time that the subject works in attempting to solve the "cross" puzzle.

SCORING:

The score on this test is the number of minutes that the subject works on the "cross" test before giving up.

FREQUENCIES OF AGES.

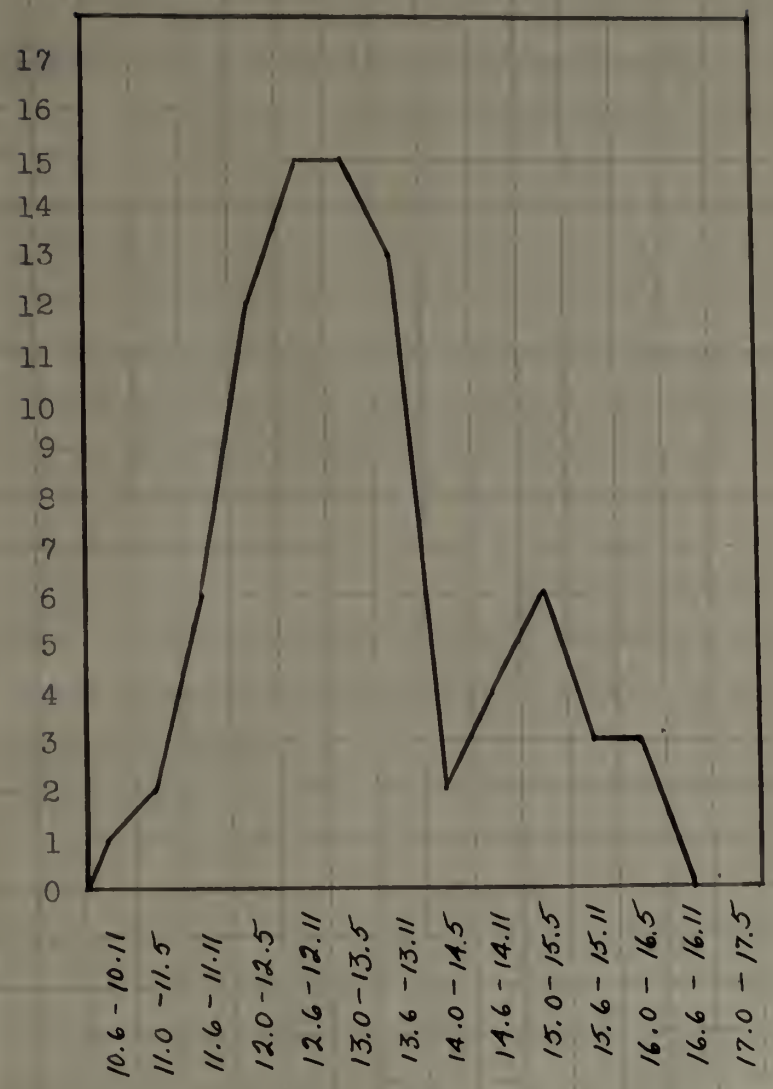


FIGURE III

FREQUENCIES OF HONOR POINTS.

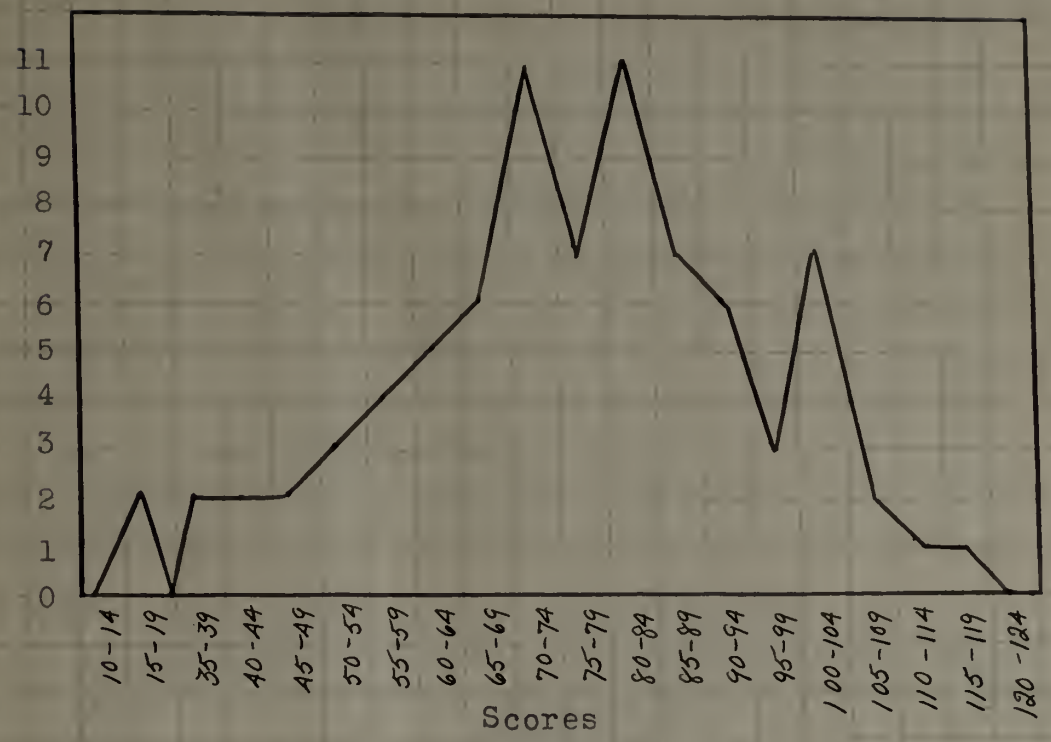


FIGURE IV

FREQUENCIES OF INTELLIGENCE SCORES.

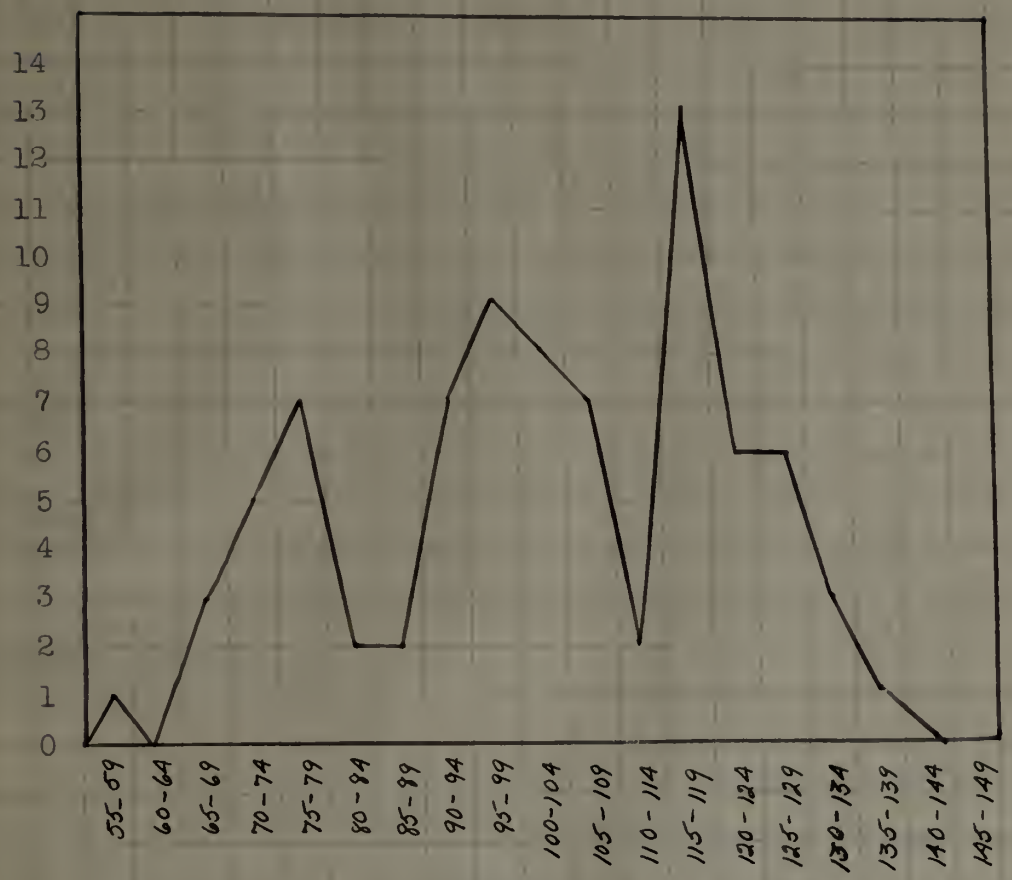


FIGURE V

FREQUENCIES OF PERSISTENCE SCORES.

FIGURE VI

FREQUENCIES OF PONTE TEST SCORES.

FIGURE VII

FREQUENCIES OF SECKLER TEST

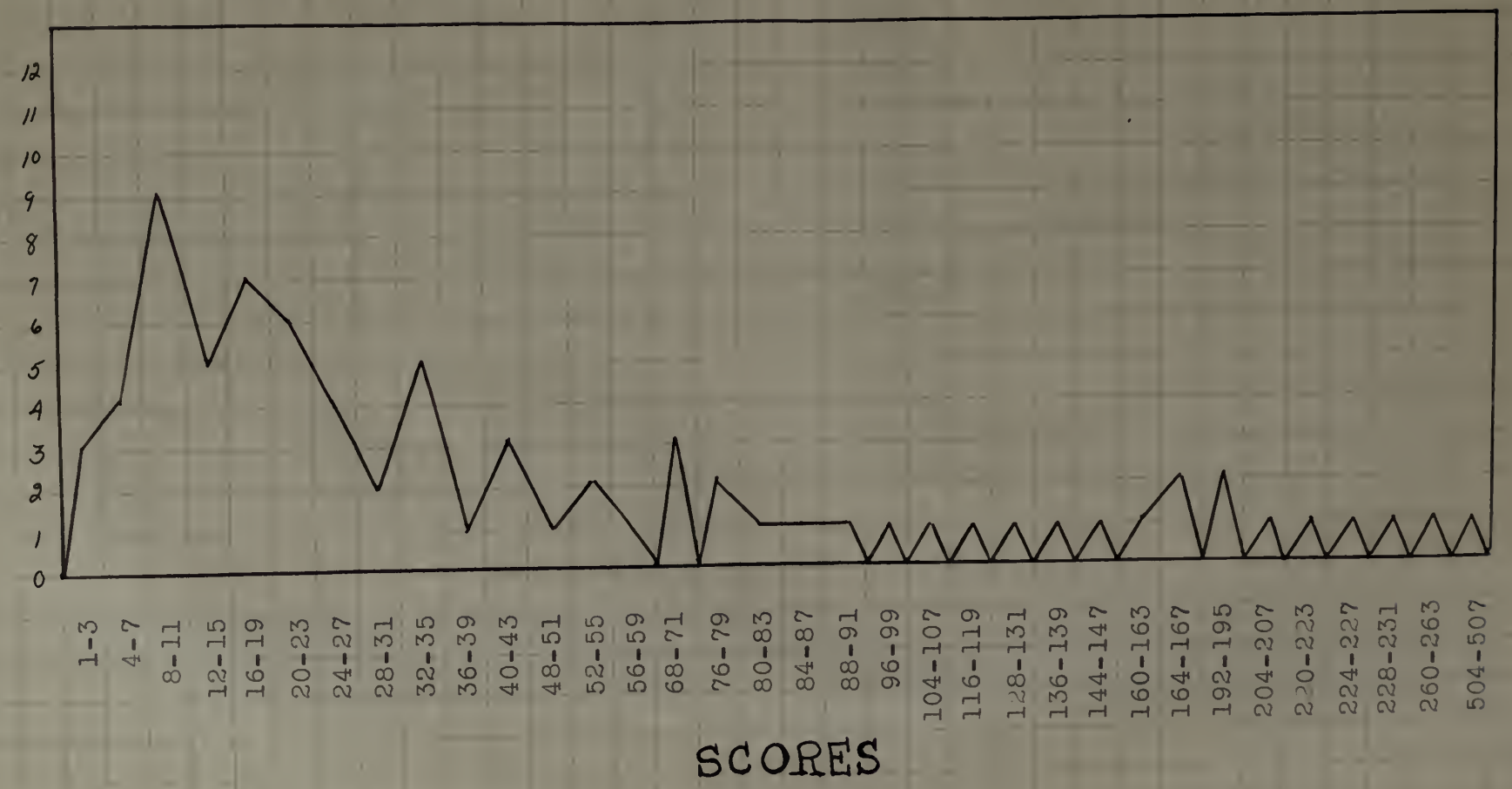


FIGURE VIII.

FREQUENCIES OF "SEC. PER TRIAL" SCORES

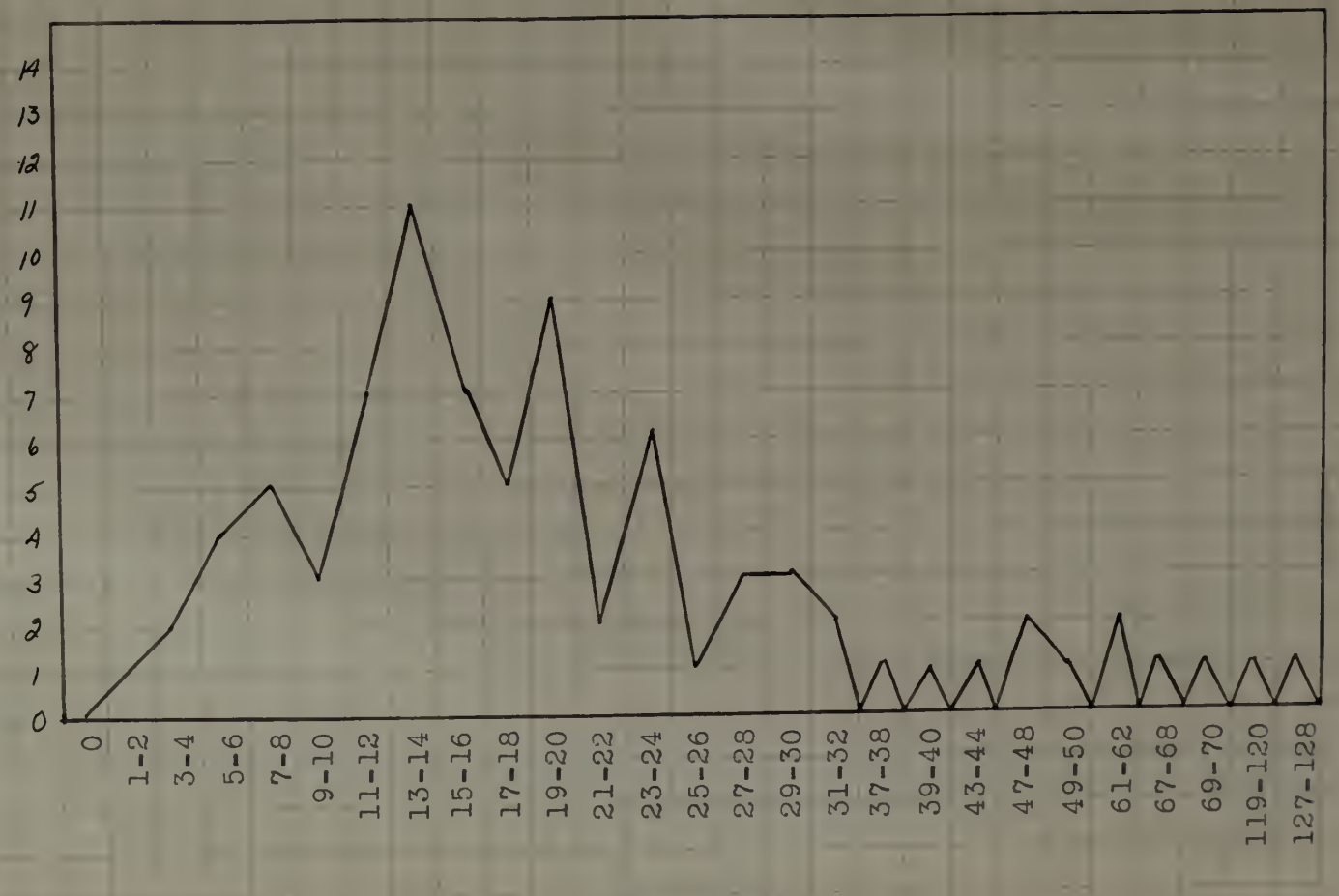


FIGURE IX.

Approved by:

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Date June 7, 1939.