AN EVALUATION OF THE HAYES ADAPTATION OF THE TERMAN-BINET INTELLIGENCE TEST FOR THE BLIND

by

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A. B. University of Kansas, 1929

Submitted to the Department of Psychology and the Faculty of the Graduate School of the University of Kansas in partial fulfillment of the requirements for the degree of Master of Arts.

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May 31, 1932

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ACKNOWLEDGMENTS

The writer wishes to acknowledge gratitude to those persons who assisted in the experimental work and organization of this thesis. Sincere thanks are extended to Margaret Fisher Baugh, Jane Poindexter Emerson, La Berta Weiss, Katherine Clark, Bertha Pratt, Gertrude Way Strong, Dorothy Shaad and Mary Alice Drennon Flint, who gave the first series of 228 mental tests at the State School for the Blind, Kansas City, Kan.; to Dr. Margery Cutsforth, Helen Gardner and Mrs. Dinsmore Alter for their assistance in giving the second series of 108 mental tests; to Mrs. Eleanor A. Wilson, superintendent of the State School for the Blind, Mr. Lloyd Ripley, principal of the Tonganoxie Grade School, and Prof. F.O.Russell for their co-operation in arranging to give the tests; to Dr. Thomas D. Cutsforth for his interest and suggestions; and to Dr. Beulah Morrison, who furnished a part of the experimental material and who gave invaluable advice and guidance during the experimental work and organization of the manuscript. In addition, the writer wishes to acknowledge that the testing material and a part of the expenses were furnished by the University of Kansas Research Grant to Dr. Cutsforth.

LIST OF GRAPHS

I. INTRODUCTION

1. Statement of Problem

The problem under consideration is an evaluation of the Hayes (7) adaptation of the Stanford Revision of the Binet-Simon Intelligence Tests for use with the blind as compared with standardization of Terman's (10) Stanford Revision of the Binet-Simon Intelligence Tests for use with seeing children. On the basis of work done with blind subjects when the Hayes adaptation was employed, the question arose as to whether or not the Hayes tests make too great concessions to the blind child for his lack of vision and do not elicit from him the best performance of which he is able. Dr. Hayes recognizes the possible validity of this question from results of early testing done in connection with his own work with the blind. Similarly, then, the question arose as to whether or not intelligence quotients of blind subjects on the Hayes tests would tend to be higher than those of normal children on the Terman Revision. Subsequent experimentation, attacking several angles of the problem, indicate that these questions were warranted.

Use of the Hayes Revision brings up several other queries intimately connected with the problem mentioned above. Terman's Stanford-Binet tests assume that standardization has included the range of environments of the normal child; can it be assumed that the environment of the average blind child is equivalent to that assumed by the Stanford-Binet tests?

If the blind child's environment is different from that included in the standardization of the Stanford-Binet, does the Hayes Revision make adequate compensation for the environmental variation? Is it possible to make any suitable adaptation for the blind from a test for the seeing? Are the environments of different blind children sufficiently similar to warrant a uniform test for all? What criticism can be made of the Hayes Revision with regard to the extensive use of verbal tests and exercises? Finally, if the average blind child is retarded, what is the scientific advantage of compensating for it in the revision of his psychological test scores? These questions will be considered in a later discussion.

2. Background of Tests

Before progressing to a discussion of experimental conditions, it is necessary to give the background for each of the tests used in this study.

Terman's Stanford Revision of the Binet-Simon scale is the result of several years of work and involved the examination of approximately 2,300 subjects, including 1,700 normal children, 200 defective and superior children, and more than 400 adults. Results for each test of the Binet scale were secured from all countries. A comparative study of these data yielded a provisional arrangement of the tests for try-out, to which were added 40 new tests. The tests were then given to selected and unselected groups of children,

the revision of the scale below the XIV year level being based almost wholly on the test results of the latter. The guiding principle was to secure an arrangement of the tests and a standard of scoring which would cause the median mental age of the unselected children of each age group to coincide with the median chronological age. Several revisions were necessary before this desired standardization was finally secured (9, p. 51).

Following is a list of the tests of the Stanford revision at each of the age levels (10):

Year III*: 1. Points to parts of body; 2. names familiar objects; 3. enumerates objects in pictures; 4. gives sex; 5. gives last name; 6. repeats sentences.

Year IV: 1. Compares lines; 2. discrimination of forms; 3. counts 4 pennies; 4. copies square; 5. comprehension, first degree; 6. repeats 4 digits.

Year V: 1. Comparison of 2 weights; 2. colors; 3. aesthetic comparison; 4. definitions; 5. patience; 6. three commissions.

Year VI: 1. Right and left; 2. mutilated pictures; 3. counts 13 pennies; 4. comprehension; second degree; 5. names coins; 6. repeats 16 to 18 syllables.

Year VII: 1. Number of fingers; 2. describes pictures; 3. repeats 5 digits; 4. ties bow knot; 5. gives differences; 6. copies diamond.

Year VIII: 1. Ball and field; 2. counts 20 to 1; 3. comprehension, third degree; 4. gives similarities; 5. definitions superior to use; 6. vocabulary, 20 words.

Year IX: 1. Date; 2. 5 weights; 3. makes change; 4. repeats 4 digits backwards; 5. three words in sentence; 6. rhymes.

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*Here, and elsewhere when reference is made to specific tests in the Hayes and Terman scales, the Roman numerals denote the year level at which the test is placed and the Arabic numerals the test within the year level.

Year X: 1. Vocabulary, 30 words; 2. absurdities; 3. copies designs; 4. reading and report; 5. comprehension, fourth degree; 6. names 60 words.

Year XII: 1. Vocabulary, 40 words; 2. defines abstract words; 3. ball and field, superior plan; 4. dissected sentences; 5. gives moral to 2 out of 5 fables; 6. repeats 5 digits backwards; 7. interprets pictures; 8. gives similarities.

Year XIV: 1. Vocabulary, 50 words; 2. induction test; 3. differences between president and king; 4. problems of fact; 5. arithmetical reasoning; 6. reverses hands of clock.

Average Adult or Year XVI: 1. Vocabulary, 65 words; 2. interpretation of fables; 3. difference between abstract words; 4. problem of enclosed boxes; 5. repeats 6 digits backwards; 6. writes in code.

Superior Adult or Year XVIII: 1. Vocabulary, 75 words; 2. Binet's pater cutting test; 3. repeats 8 digits; 4. repeats thought of passage heard; 5. repeats 7 digits backwards; 6. ingenuity test.

The Irwin-Hayes test (7) is an adaptation of the Terman-Binet test (10) for use with the blind. In 1914, R.B.Irwin had sensed the value of intelligence tests for persons without vision. With the assistance of Dr. H.H. Goddard, he arranged a tentative series of tests by taking the Terman-Binet scale as a basis. They first struck out those tests which could not be given without the use of vision, made additions from various sources, and arranged the whole collection of tests in year groups according to Irwin's judgment of the abilities of blind children. The tests were then used in various homes for blind babies, residential schools for the blind, and classes for the blind in public schools. Systematic routine testing with Irwin's adaptation was carried out for some time, so that by the end of 1922 the tests had been given to more than 1,600 pubjects with

defective vision (5).

The data thus accumulated seemed to justify an attempt to standardize the tests and to distribute a guide. In 1923, Hayes prepared and distributed a Provisional Guide for Testing the Blind, called the Scissors and Paste Adaptation. The arrangement of tests was based upon a careful, though incomplete, statistical study of passes and failures by age groups, supplemented by the judgment of psychologists who had used the tests continuously since 1916. Hayes stressed the practical need for a scale which would measure all children as they came to schools for the blind, as well as the advantage of comparing them with seeing children of the same ages, his experience leading him to minimize the importance of the age and degree of blinding. Following distribution of the 1923 Guide, further study of the detailed results and the accumulation of additional data through use of the Guide with 746 more children, together with the trial of a series of supplementary tests with 418 pupils in schools for the blind, made it possible to present a more satisfactory re-arrangement of the tests. The 1930 arrangement is matched to the Terman scale in the number of tests and follows the Terman Revision more closely (7).

Following is a list of new tests introduced to replace those in the Terman scale which could not be given to subjects without vision (7):

Year IV: 2. comparison of two cubes.

Year V: 3. Two digits backwards.

Year VI: 5. Counting irregular series of 4 to 6 taps.

Year VIII: 1. Knows birthday.

Year IX: 5. Problematic situations.

Year X: 2. Lines B, C, D from Knox Cube test;
3. counting irregular series of 9 to 12 taps.

Year XII: 7. Lines E, F, G from Knox Cube test.

Year XIV: 3. Completing analogies.

Year XVI: 3. Generalizations; 6. proverbs.

Year XVIII: 2. Lines H, I, J from Knox Cube test.

The remainder of the tests in the Terman scale which do not involve the use of vision have been retained in the Hayes scale. In some instances substitution of material has been made; use of mutilated dolls in the Hayes test replaces the mutilated pictures in the Terman; in the comparison of lines, raised lines are used.

In other cases where tests in the Terman scale are retained they are shifted to a higher age level in the Hayes. Thus, the VI year old Terman subject must name four coins; the Hayes subject must name six coins at the VIII year level. Likewise the first vocabulary test appears in the Terman scale at the VIII year level, while the same test does not appear in the Hayes until year X. Arrangement of 5 weights appears in the Terman scale at IX years, in the Hayes at XII years; the absurdities appear in the former at the X year level and in the latter at the XII year level. Finally, differences between abstract terms are asked for at the XVI year level

in the Terman scale, at the XVIII year level in the Hayes scale (7) (10). This shifting of tests to a higher age level in the Hayes adaptation indicates a tendency to smooth the path for the blind child, which tendency may lead either to over-rating him mentally or to under-stimulation to the degree where his best efforts are not called forth.

Both the Hayes and Terman tests are scored according to standards set forth in Terman's The Measurement of Intelligence (9, Chapters IX to XX, inclusive). Hayes also has supplied a standard measure for scoring those tests not included in the Terman scale (7).

II. FIRST SERIES OF TESTS, STATE SCHOOL FOR THE BLIND, KANSAS CITY, KAN.

The first series of tests was given to blind children at the State School for the Blind in Kansas City, Kan. The Terman scale standardized for seeing children was given first in the spring of 1928, followed by the Hayes scale approximately a year later in the spring of 1929.

1. Testing Conditions

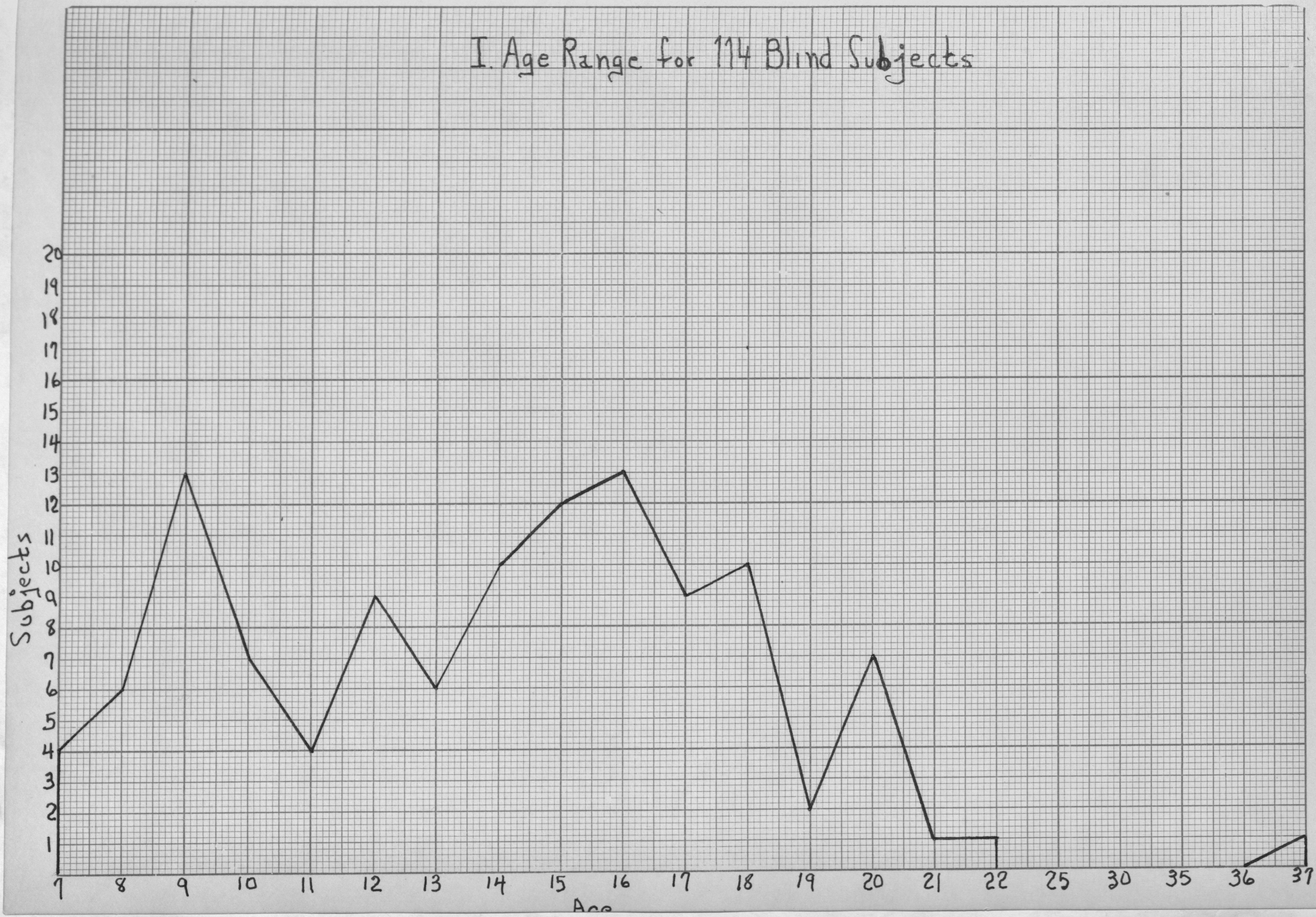
One hundred and fourteen subjects were tested on both the Terman and Hayes scales by eight trained examiners; one group of four examiners gave the Terman tests while a different group of four examiners gave the Hayes tests, hence testing conditions were not kept constant to the extent of having the same examiner give both tests to the same subject. The subjects were tested individually in an unused room apart from the rest of the school. In giving the Hayes tests the 1923 Guide, or Scissors and Paste Adaptation (6), was used and those subjects with any amount of vision at all were blindfolded. The blindfold precaution was not carried out in the giving of the Terman tests, but those tests requiring vision - such as description of pictures in year III, comparison of lines, discrimination of forms and copying square in year IV, and the like - were not included. All of the 114 subjects had had varying amounts of training in the school previous to taking the tests.

In this series of tests the advantage of practice and familiarity with the tests was with the Hayes scale, in that the Terman scale was given first. As has already been pointed out, the Hayes scale is adapted from the Terman, so a majority of the tests - those which may be taken either by blind or seeing, such as pointing to nose, mouth, eyes and hair; naming familiar objects; giving sex; giving last name; and repeating sentences in Year III, et cetera - are identical in both scales.

2. Comparison of Results

The age range for 114 blind subjects is shown on graph I. Ages were counted on the basis of 6 months, that is, if a subject were 7 years, 5 months old he was called 7 years, and if he were 7 years, 9 months old he was called 8 years. Other age ranges were worked out in the same manner. The range for 114 blind subjects includes 113 subjects varying in age from 7 years to 22 years, inclusive, with the addition of one 37 year old subject. Because of incomplete information and also because of marked differences in grade classification in the blind school as compared with the public school it is impossible to give a grade range for these subjects.

On graph II, a comparison of I.Q.'s on the two groups of tests is shown. Here, and on subsequent graphs, I.Q.'s were grouped as follows: those falling between 45-50, 51-55, 56-60, 61-65, and so forth, on the I.Q. distribution were grouped together. It may be seen that I.Q.'s on the Hayes


I. Age Range for 114 Blind Subjects
Subjects
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
7
8
9
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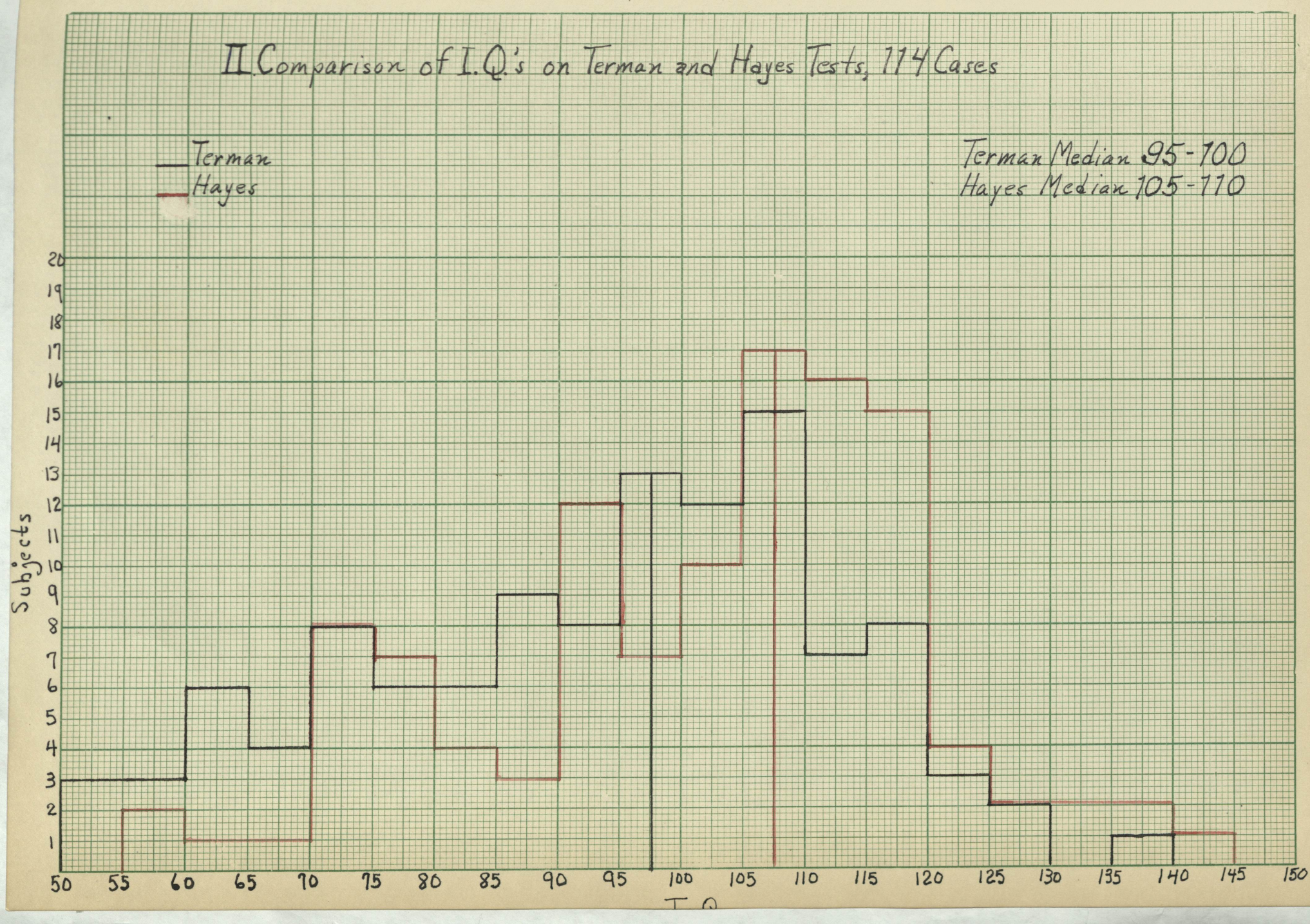
35
36
37
Age


II. Comparison of I.Q.'s on Terman and Hayes Tests, 114 Cases
Terman
Hayes
Terman Median 95-100
Hayes Median 105-110
Subjects
I.Q.
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125 130 135 140 145 150

tests start 5 I.Q. points higher at the lower end of the I.Q. distribution and finish 5 I.Q. points higher at the upper end of the distribution than on the Terman tests. Likewise, it may be noted that a greater number of subjects had higher I.Q.'s at the upper end of the I.Q. distribution on the Hayes tests than on the Terman. The median for the Terman distribution falls between 95-100 I.Q. points, while the median for the Hayes falls 10 points higher - between 105-110 I.Q. points. These results are indicative of the fact that the Hayes scale is in general less difficult than is the Terman scale and especially is it easier in the upper age levels than is the Terman.

Only 12 subjects of the 114 blind tests increased more than 5 I.Q. points on the Terman scale over the Hayes. The average increase in I.Q. on the Terman scale for these 12 is 8 I.Q. points. Thirty-seven subjects had approximately the same I.Q. on both scales; that is, I.Q.'s differing within a range of 10 I.Q. points - 5 points up or down - are considered the same. The remaining 65 subjects showed an increase of more than 5 I.Q. points on the Hayes scale over the Terman; the average increase for this group is 14 + I.Q. points (see appendix).

3. Summary

These results indicate that tests in the Hayes scale are standardized higher at each age level than in the Terman scale, in that a majority of I.Q.'s show a decided increase on

the Hayes over the Terman. This comparison of I.Q.'s on both the Hayes and Terman tests, based on statistical data, would seem to justify the original observation that the Hayes test is easier than the Terman. In finding an average increase of 14 + in I.Q. points on the Hayes over the Terman, conclusions would point to the Hayes scale being standardized that many I.Q. points higher than the Terman scale. Moreover, by the greater bunching of Hayes I.Q.'s at the upper end of the I.Q. distribution, results are interpreted to show that especially standardization on the Hayes is higher in the upper age levels than on the Terman.

III. SECOND SERIES OF TESTS, TONGANOXIE, KAN., GRADE SCHOOL

1. Testing Conditions

The second series of intelligence tests was given to seeing children in the grade school at Tonganoxie, Kan. Since an attempt was made to co-operate with the principal of the school in his work, the majority of the children tested were problem cases; this fact should, however, make little or no difference in ultimate conclusions concerning our problem.

Four trained persons gave the Hayes 1930 Revision to 54 subjects and approximately a month later the Terman Revision was given to the same subjects. In giving the Hayes Revision, the subject was blindfolded throughout the testing. Every effort was made to keep testing conditions as constant as possible: each subject was tested individually on both tests in a room apart from the rest of the school, while each examiner re-tested her original subjects. In this way, only the minimum amount of adjustment was called for on the part of the children tested.

Subjects were taken from the first to the eighth grades, inclusive, while one ninth grade subject from Oread High School, Lawrence, Kans., was included. It had been planned to do further testing at Oread, but difficulties arose which prevented. The subjects fall within an age range from 6 to

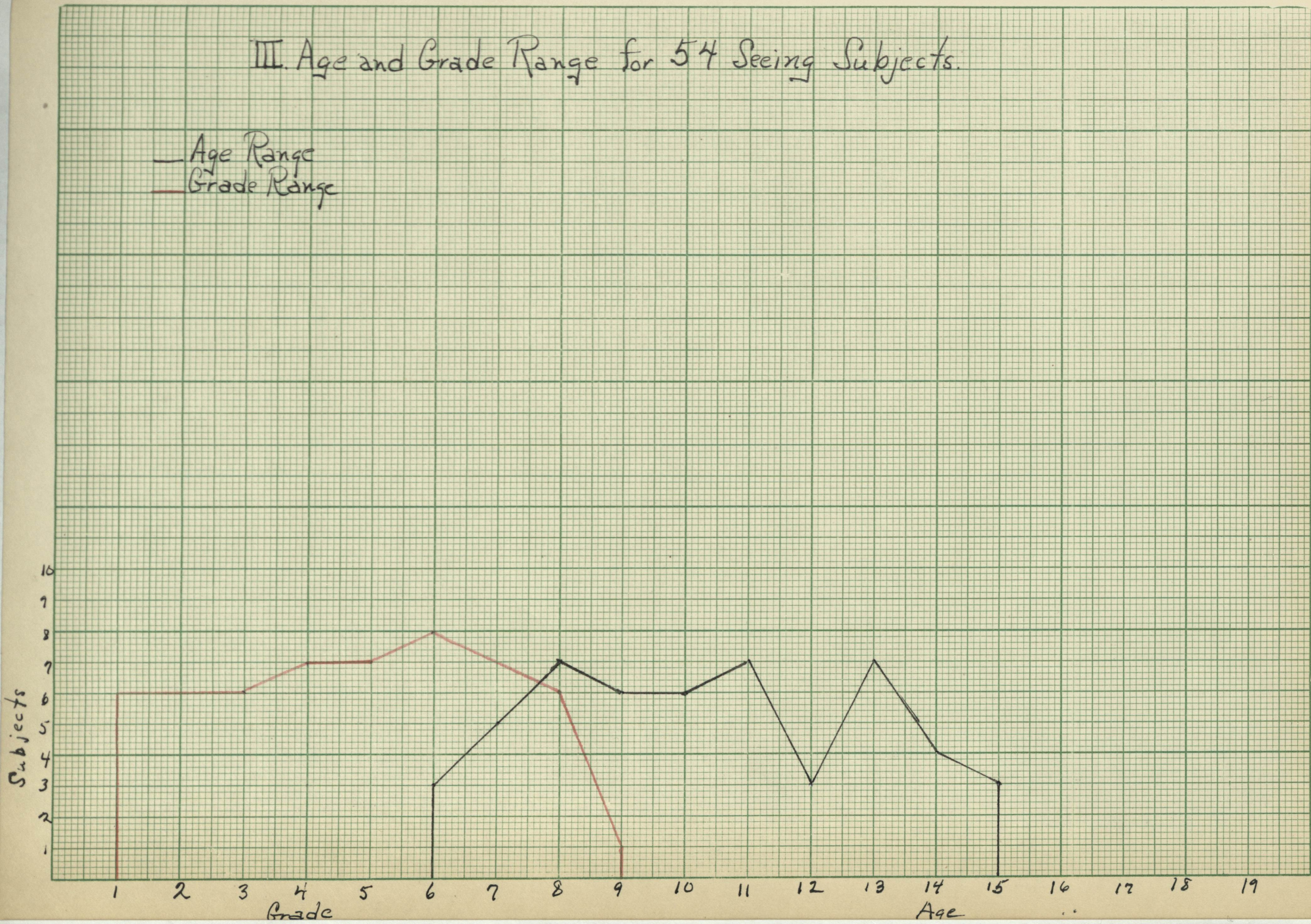
15 years, inclusive. As may be seen on graph III, the grade range gives the more even distribution of subjects.

Before proceeding to a comparison of the test results, several factors should be considered. The subjects, since they attended a small town school, were not "test-wise"; no similar testing had been done in the school. As already indicated, the advantage of practice and familiarity was given in this case to the Terman Revision since the Hayes Revision was given first and many of the tests are identical in both scales. Moreover, during the Hayes test the seeing child was handicapped by the blindfold in that he was forced to make adjustments to what was for him a most unusual and novel situation. These facts should be kept in mind during a study of the results, which indicate that in spite of the advantage of practice and acquaintance with the tests being on the side of the Terman performance and the disadvantage of non-familiarity, non-practice and adjustment to an unusual situation on the side of performance on the Hayes, the intelligence quotients tend to be higher on the Hayes.

2. Comparison of Test Results

A comparison of the I.Q.'s on the Hayes adaptation and the Terman Revision for each subject shows two subjects coming out exactly the same in I.Q. on both scales, 20 having higher I.Q.'s on the Terman than on the Hayes and 32 with higher I.Q.'s on the Hayes. Tabulating the results in a slightly different manner by assuming the difference of all

III. Age and Grade Range for 54 Seeing Subjects.



I.Q.'s within a spread of 10 points - 5 points up or down - to be the same, the following is shown: 26 subjects have the same I.Q. on both the Hayes and the Terman, 6 have an increase in I.Q. on the Terman over the Hayes, while 22 have an increase in I.Q. on the Hayes test over the Terman (see appendix).

According to the latter tabulation, the 6 subjects with higher I.Q.'s on the Terman showed an average increase of 13 + I.Q. points; the 22 subjects with higher I.Q.'s on the Hayes showed an average increase of 10 + I.Q. points. However, some explanation should be made in three of the six cases with increased I.Q. on the Terman; in these three cases a startling difference was shown.

Subject F.A., male, age 13, had an I.Q. of 73 on the Hayes and 97 on the Terman, making an increase of 24 I.Q. points on the latter. His basal age on the Hayes was 8 years and his highest achievement in year XII: 5; while his basal age on the Terman was X years and his highest achievement was in year XVI: 4. The subject had more than usual difficulty in adjusting to the blindfold situation during the Hayes test. He was embarrassed by the blindfold and kept pulling at it until the testing was stopped, to be resumed later.

L.G., female, aged 8 years, 2 months, had an I.Q. of 77 on the Hayes and 92 on the Terman, a difference of 15 I.Q. points. She had a basal age of III years on the Hayes and her highest achievement was in year VIII: 3; her basal age on the Terman was VI and her highest achievement in year IX: 6.

She was timid while wearing the blindfold and at times unresponsive, while at others she talked irrelevantly. She failed all but two tests where manipulation of objects was required.

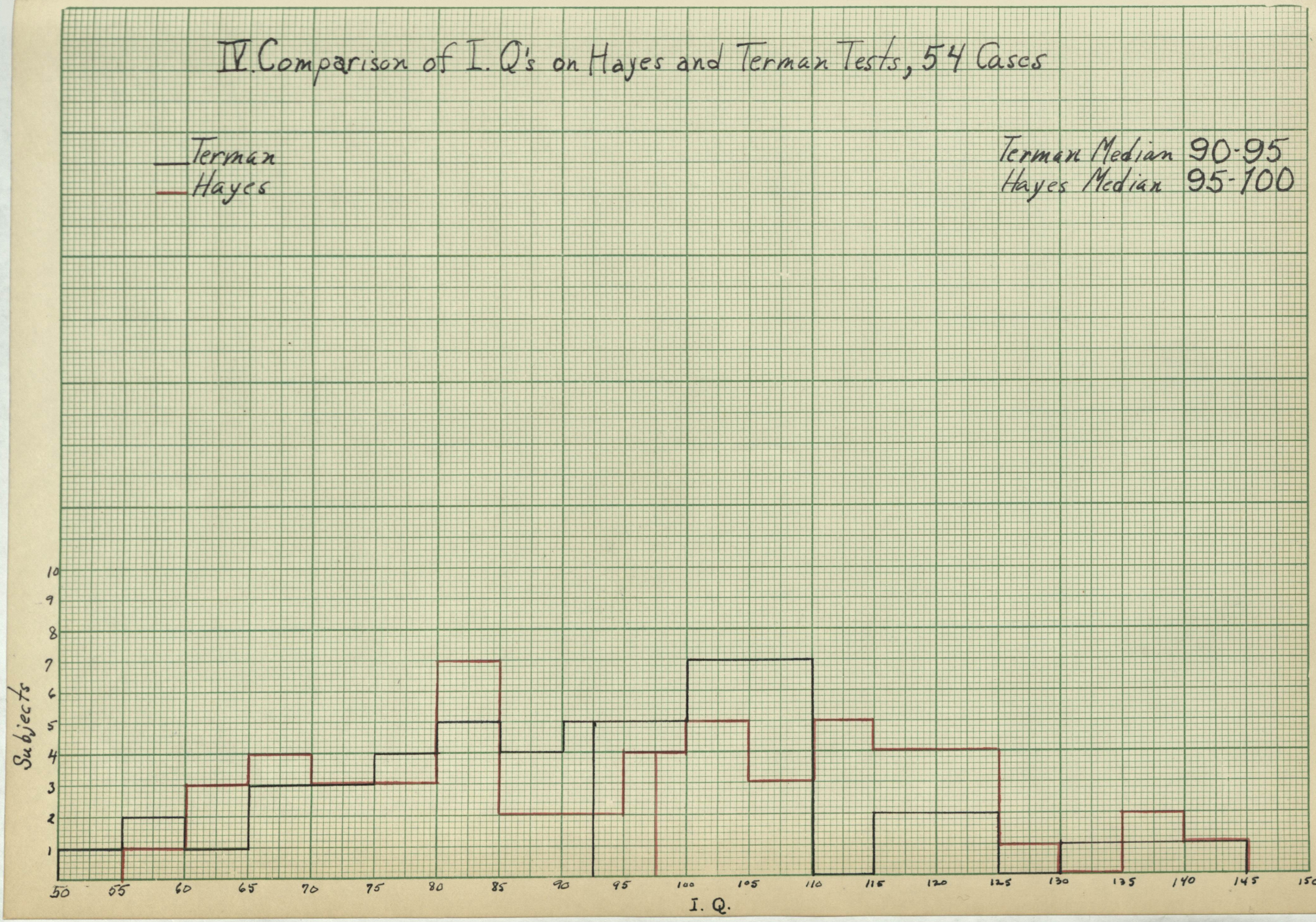
R.O., male, aged 6 years, 9 months, had an I.Q. of 84 on the Hayes, 103 on the Terman, a difference of 23 I.Q. points. His basal age was III years in Hayes and his highest achievement in year VIII:3; basal age in Terman was VI years and highest achievement in year VIII:4. He was uncomfortable wearing the blindfold, insisting that he could not tell the examiner many of the simplest things. In many cases his answers were irrelevant.

A comparison of test results is made on graph IV. It may be seen that subjects gained 5 I.Q. points on the Hayes test at the lower range of the I.Q. distribution and that relatively more subjects made higher I.Q.'s on the Hayes than on the Terman at the upper end of the I.Q. distribution. The median falls 5 I.Q. points higher for the Hayes distribution of subjects; the median is between 90 - 95 I.Q. points for the Terman, and between 95 - 100 I.Q. points for the Hayes. These results indicate that in general the Hayes tests are easier than the Terman tests, and especially that they are less difficult in the higher age levels. A scatter of successes on both tests in the higher age levels on both tests will show this last fact to be true.

3. Scatter at Higher Age Levels

Sixteen subjects out of the 54 tested progressed to

IV. Comparison of I. Q's on Hayes and Terman Tests, 54 Cases



tests in the higher age levels - that is, beyond year XII. Of the 16 subjects, 6 passed higher tests on the Hayes than on the Terman and 11 had more successes on individual tests on the Hayes than on the Terman. Four of the 16 subjects made their highest success on the same test in both scales. Three of the 16 passed higher tests on the Terman than on the Hayes and 4 scored more successes on the Terman than on the Hayes. Following is a table showing the scatter of all successes made by the 16 subjects on individual tests of the Hayes and Terman scales at each year level beyond XII:

TABLE I

SUBJECT	HAYES	TERMAN
M.B.	XIV: 1,2,3,4 XVI: 2,3,4 XVIII: 2,5	XIV: 2,3 XVI: 2,4 XVIII: 3
R.B.	XIV: 1,2,3,4,5 XVI: 1,2,3,6 XVIII: 6	XIV: 3,4,5,6 XVI: 2,5 XVIII: 4
M.Bo	XIV: 2,6 XVI: 3	XIV: 4 XVI: 2,4
V.C.	XIV: 2,3,5	XIV: 6
D.D.	XIV: 1,2,3,4,5,6 XVI: 2,3,4,6	XIV: 2,3,4,5,6 XVI: 2,3,4
M.F.	XIV: 1,2,3,5,6 XVI: 2,4,5,6 XVIII: 2,4	XIV: 1,2,3,5 XVI: 2,3,4,5,6 XVIII: 2,3,4
C.L.	XIV: 1,2,3,4,6 XVI: 2,3,4,6 XVIII: 6	XIV: 2,3,4,6 XVI: 2,3,4
D.L.	XIV: 1,2,3,4,5,6 XVI: 1,2,3,4,5,6 XVIII: 1,4,5	XIV: 2,3,4,6 XVI: 2,4,5,6 XVIII: 2,3,5

TABLE I (cont.)

SUBJECT	HAYES	TERMAN
E.L.	XIV: 1,2 XVI: 3	XIV: 2
C.M.	XIV: 1,2,4,5,6 XVI: 1,3,4,6 XVIII: 4	XIV: 2,3,4,5,6 XVI: 2,3,4,6 XVIII: 2,4
D.M.	XIV: 2,3,4 XVI: 3,6 XVIII: 3	XIV: 3,4
J.M.	XIV: 1,2,3,4,5,6 XVI: 2,3,4,5 XVIII: 3	XIV: 1,2,4,5,6 XVI: 2,4,5,6 XVIII: 3,4,5,6
E.P.	XIV: 1,2,4,5,6 XVI: 4,6 XVIII: 2	XIV: 2,3,4,5,6 XVI: 4,6
F.T.	XIV: 2,3 XVI: 3,4	XIV: 2,3
R.W.	XIV: 1,2,3,4,5,6 XVI: 1,2,3,4,5,6 XVIII: 1,3,4,6	XIV: 1,2,4,5,6 XVI: 2,3,4,5,6 XVIII: 2,3,4,6
T.W.	XIV: 3,4,6 XVI: 2,3,4,6 XVIII: 4	XIV: 2,4,5,6 XVI: 2,4 XVIII: 3,4,6

4. Summary

In summary, results of the second series of tests indicate that the Hayes scale is in general standardized in difficulty of tests below that of the Terman scale. It has been shown (1) that I.Q.'s made by seeing children, handicapped by a blindfold, on the Hayes test tend to be higher than I.Q.'s on the Terman; (2) that although the average increase in I.Q. was greater for the Terman than for the Hayes.

this increase may probably be accounted for by the extreme difficulty of some of the subjects to adjust to the unusual situation of the blindfold; and (3) that tests in the higher age levels in the Hayes are less difficult than the corresponding age levels in the Terman.

IV. COMPARISON OF RESULTS OF FIRST AND SECOND SERIES OF TESTS

Conditions under which each series of tests were given has been stated and it may be seen that in so far as possible such conditions were kept constant. The main point of departure was the use of the 1923 Revision (6) in giving the Hayes tests in the first series and the use of the 1930 Revision (7) in the second series.

In the first series of tests, the advantage was given to the Hayes scale by virtue of the Terman scale being given first, while in the second series the advantage was given to the Terman scale, the Hayes being given first.

Moreover, it must be remembered that the seeing subjects of the second series were under the strain of adjusting to the blindfold situation while being given the Hayes tests, and that all tests of the Hayes scale - including those devised especially for the blind - were given to them. In taking the Terman tests, the blind subjects had relatively little adjustment to make as only those tests were given which could be successfully executed without the use of vision.

It has been shown that not only do a majority of the blind subjects tested on both the Hayes and Terman intelligence scales make a higher score on the former, but also that a majority of seeing children tested under the handicap of a blindfold make higher scores on the Hayes. In addition, results show that a greater number of both blind and seeing

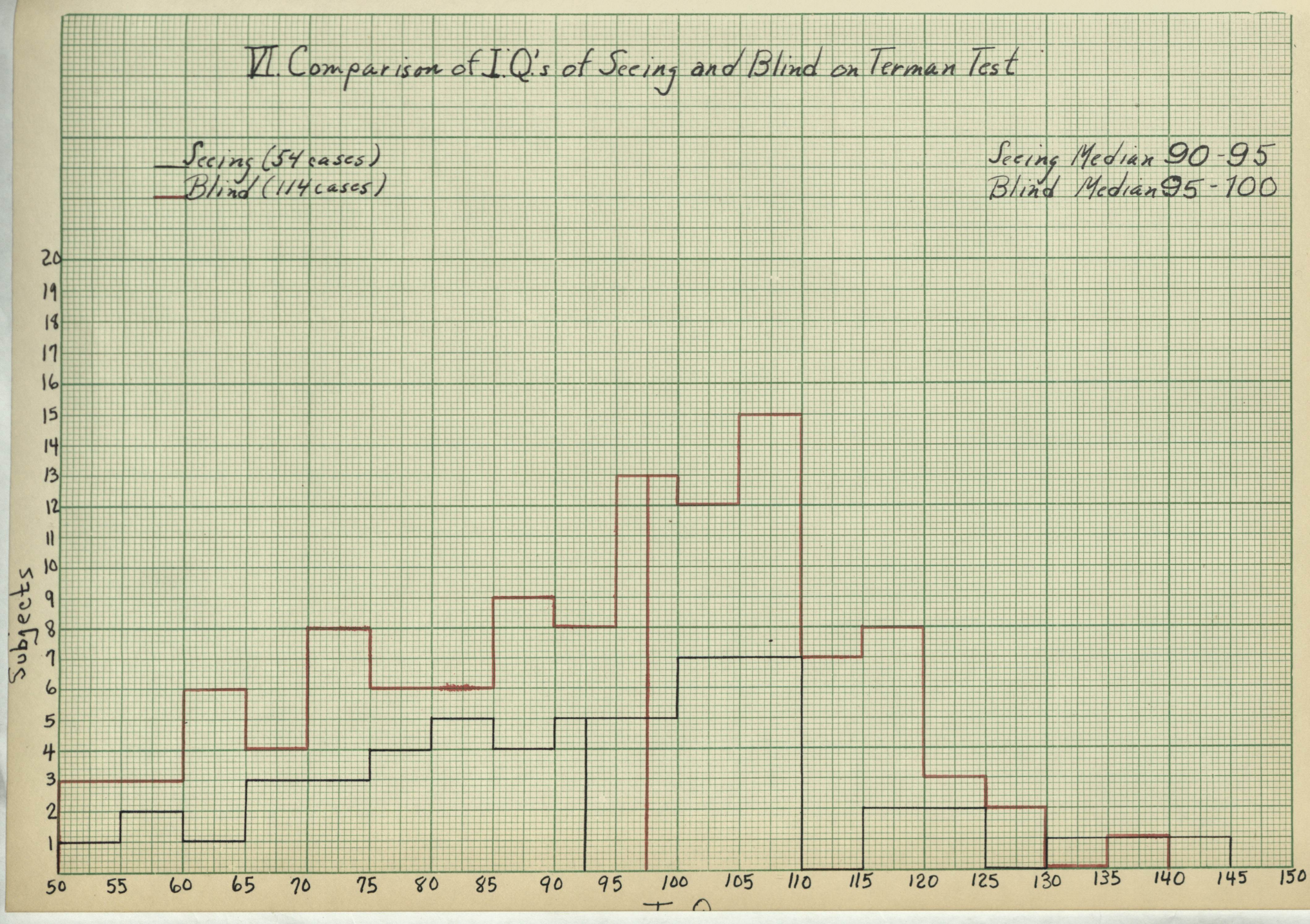
subjects make higher I.Q. scores on the upper half of the I.Q. scale on the Hayes than on the Terman. Thus data are interpreted to show that the Hayes scale is standardized higher than that of the Terman on the I.Q. distribution, and especially is this standardization higher in the upper end of the I.Q. distribution.

The average increase in I.Q. on the Hayes scale over the Terman is 14 + in the first series of tests and 10 + in the second series. An average increase for both series is thus 12 + and on this basis it may be stated that the Hayes scale is standardized approximately 12 + I.Q. points above that of the Terman scale.

On graph V, a comparison of I.Q.'s for the seeing and blind on the Hayes scale is made. Making allowance for the greater number of blind cases (114) over the seeing (54) the distribution compares favorably for the seeing subjects, although the peak of the distribution of the seeing comes 20 I.Q. points below that for the blind on the I.Q. distribution. The median for the blind distribution falls between 105 - 110 I.Q. points, while the median for the seeing falls 10 points lower - between 95 - 100 I.Q. points. A fairly even distribution of subjects is shown with scores coinciding at both ends of the I.Q. distribution.

Graph VI shows a comparison of I.Q.'s for the seeing and blind on the Terman scale. Here the peak of distribution on the I.Q. scale comes at the same point for both groups. However, actual medians show a difference; the median for the

V. Comparison of I. Q.'s of Seeing and Blind on Hayes Test


VI. Comparison of I.Q.'s of Seeing and Blind on Terman Test
Seeing (54 cases)
Blind (114 cases)
Seeing Median 90-95
Blind Median 95-100
Subjects
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
50
55
60
65
70
75
80
85
90
95
100
105
110
115
120
125
130
135
140
145
150
I.Q.

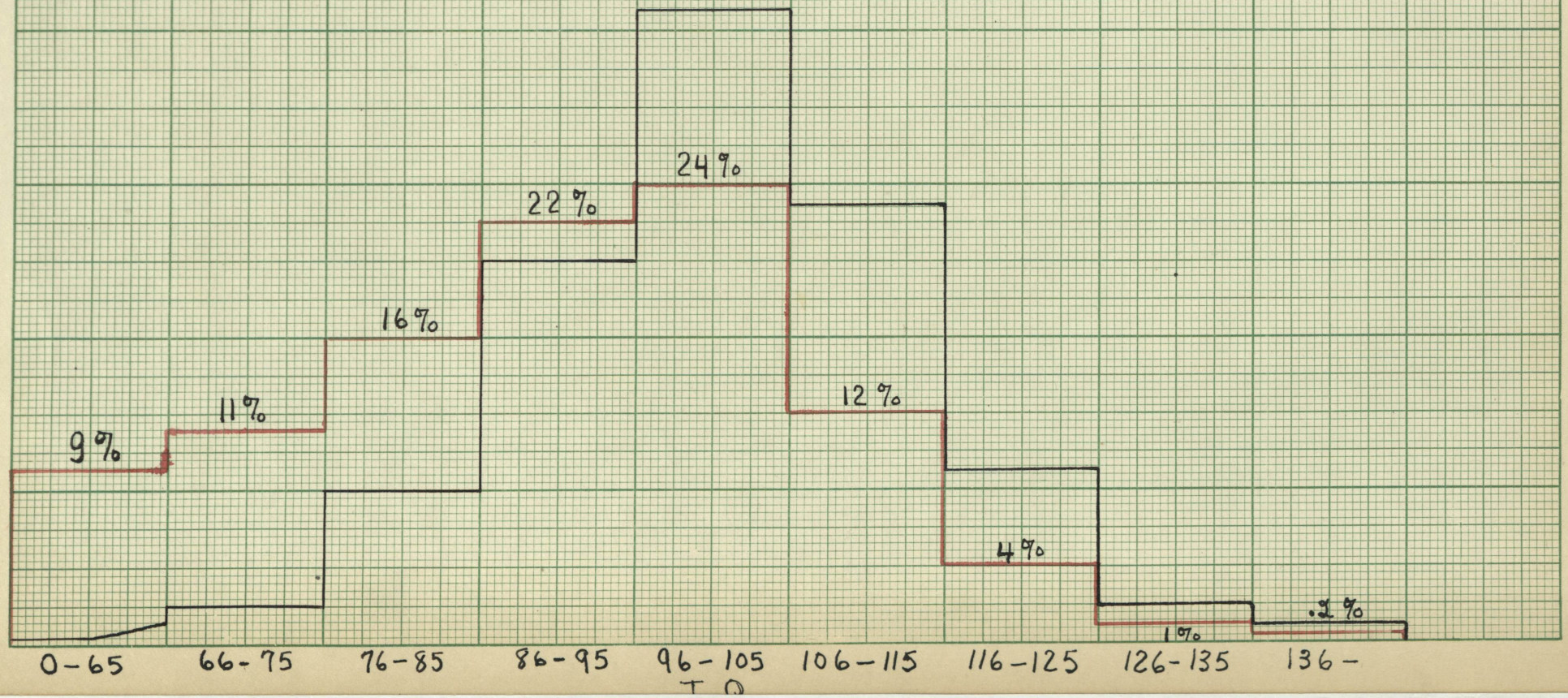
seeing subjects falls between 90 - 95 on the I.Q. distribution, while the median for the blind subjects falls between 95 - 100 on the I.Q. distribution. While the distribution for both groups begins at 50 I.Q. points at the lower end of the I.Q. distribution, comparison at the upper end of the scale is slightly in favor of the seeing, the distribution going 5 I.Q. points higher. Here again, however, a fairly even distribution of both groups is found.

On graph VII, a comparison of I.Q.'s for 1,000 seeing children tested by Terman (9, p. 66) and 1170 blind children tested in nine schools for the blind is shown. The graph giving this comparison was made by Dr. Hayes in 1921. The heavier distribution of children falling at the lower end of the I.Q. distribution on the Hayes tests indicates that blind children, as compared to seeing children, are retarded.

III. Distribution of Intelligence Quotients for Seeing and Blind

(Hayes, 1923)

— 1000 Sighted Children tested by Terman
— 1170 Blind Children in 95 Schools for the Blind



V. SPECIAL STUDIES OF SEPARATE HAYES TESTS GIVEN TO SEEING CHILDREN BLINDFOLDED

A special study of individual Hayes tests given to seeing children blindfolded has been made because (1) the results are interesting in themselves, and (2) the results in some instances point out general trends which are pertinent to the main problem.

Where corresponding tests are found in both the Hayes and Terman scales, comparison of the success or failure of each subject on both tests has been made. In those tests appearing only in the Hayes scale, successes and failures have been studied in relation to the age of the subject or the highest test passed by him on the Hayes scale.

1. COINS

Terman requires identification of 3 out of 4 coins (nickel, penny, quarter, dime) at the VI year level; Hayes requires identification of 5 out of 6 coins (nickel, penny, quarter, dime, silver dollar, half-dollar) at the VIII year level (7) (10).

Seventeen out of 54 subjects took the coin test on both the Hayes and Terman. Of the 17 taking both tests, 17 passed the Terman, while 13 failed the Hayes. Four subjects passed both the Hayes and Terman. Similarly, a high proportion of failures is found in a total of 37 subjects taking the Hayes coin test, of whom 24 failed and only 13 succeeded.

Failure to identify the quarter occurred twice in the Terman test; these were the only mistakes. In the Hayes test, failure to identify the silver dollar occurred 20 times; on the penny 17 times, on the half-dollar 11 times; on the dime 8 times; on the nickel 8 times; and on the quarter 5 times.

The high number of failures on the Hayes coin tests may be accounted for by the fact that the subjects were blindfolded and had to identify the money by touch. Types of failure included mistaking one coin for another, failure to identify object as money, and failure to handle the coin as a means of identification. The second type included identification of the coins as buttons by 3 subjects.

That the silver dollar was missed most often brings up the question of fairness of its inclusion in the test; in recent years the paper dollar has become so widely used that a silver dollar is only rarely seen or handled. One 12-year-old boy laughed as he named the coin and said that he had seen only three silver dollars in his life; another little girl identified it as a "compact", an object much more familiar and meaningful to her in her everyday life than the silver dollar in her hand. Other failures were due to its identification as a half-dollar. These failures indicate that the items on mental testing scales should be revised to keep pace with the changes of the business and social world in which the child lives.

2. FREE ASSOCIATION

The free association test, in which the subject is asked to name 60 words (sentences and counting not permitted) in three minutes, appears in both the Terman and Hayes scales in year X (7) (10).

Thirty-seven subjects took both tests; out of that number, 16 subjects failed both tests and 14 subjects passed both tests, while 4 subjects passed the Terman test and failed the Hayes and 3 subjects passed the Hayes test and failed the Terman. Three additional subjects who took only the Hayes test failed it.

It would be expected that the seeing child, able to obtain stimulus from the objects about him, would be greatly superior to the blindfolded child in naming isolated words leading to success in this test. However, this expectation is not substantiated by the results, which show that the child does practically the same whether blindfolded or allowed the use of vision. On the basis of these results it may be assumed that the blind child is probably not handicapped by his lack of vision in his ability to pass the free association test.

3. WEIGHTS

In this test five weights (3,6,9,12,15 grams) are placed before the subject to be arranged in order of heaviness. Credit is given for correct arrangement in two of three trials. The test is placed in year XII in Hayes, in

year IX in Terman (7) (10).

A total of 33 subjects attempted this test on both Hayes and Terman scales; out of that number 4 passed the Hayes and failed the Terman, 13 passed the Terman and failed the Hayes, 8 failed both and 8 passed both.

These data indicate that the child makes better judgments with vision than he makes while blindfolded, which might be interpreted as justification for the author's placing the test in a higher age level on the Hayes scale. However, such evidence is certainly not conclusive.

4. CLOCKS

In this test the experimenter presents the following: "Suppose it is six-twenty-two o'clock, that is, twenty-two minutes after six; can you see in your mind where the large hand would be and where the small hand would be?" "Now, suppose the two hands of the clock were to trade places, so that the large hand takes the place where the small hand was, and the small hand takes the place where the large hand was, what time would it then be?" Two additional problems are given and credit is received for the correct solution of two out of three problems. This test is placed in year XIV in both the Hayes and Terman (7) (10).

Twenty-two subjects took the test both on the Hayes and Terman. Of the twenty-two, 5 failed the Hayes and passed Terman; 2 failed the Terman and passed Hayes; 6 failed both and 9 passed both.

A slight advantage for the correct solution of these problems is shown to be with the seeing subject. In connection with this the question might arise as to the reality of a clock for the actually blind subject. In this test the subjects were all visually acquainted with clocks, being only blindfolded for the Hayes test, yet successful achievement on the test occurred more often when the subject could see. Accordingly, the fairness of the problem for a subject blind from birth or early childhood could very easily be debated.

5. ENCLOSED BOXES

In this test a box is shown and the subject is asked to suppose that it contains two smaller boxes inside of it and that each of the smaller boxes contains a little tiny box. Three additional problems progressing in difficulty are given. Credit is gained on the test for correct solution of three of the four problems within one-half minute each. This test is placed in year XVI in both Hayes and Terman (7) (10).

Eighteen subjects took both tests. Out of the eighteen, 3 failed on the Hayes and passed Terman; 1 passed on the Hayes and failed Terman; 10 passed both tests; and 5 failed both tests.

Results tend to show that this is a legitimate test on scales intended for either the seeing or the blind.

6. VOCABULARY

Of the two lists of vocabulary supplied for the Hayes and Terman tests, only one was given at a time, in general List I being given on the Hayes test and List II being given on the Terman test. The two lists, supposedly of equal difficulty, are identical on both the Hayes and Terman scales. (7) (10).

The first vocabulary test appears in year X in the Hayes scale, in year VIII in the Terman scale. For credit on the test when only one list is given the Hayes scale requires 10 correct definitions in year X, 15 in year XII, 20 in year XIV, 25 in year XVI, and 30 in year XVIII. The Terman scale requires for credit 10 correct definitions in year VIII, 15 in year X, 20 in year XII, 25 in year XIV, 33 in year XVI, and 38 in year XVIII. Thus it may be easily seen that at the outset the Terman requirements are in advance of the Hayes.

Fifty-three subjects took the vocabulary test on both the Hayes and Terman scales, 1 subject not reaching the test on either scale. Out of the fifty-three subjects, 20 gave a higher number of correct definitions on the Terman scale than on the Hayes, 27 gave a higher number of correct definitions on the Hayes scale, while 6 subjects gave the same number of definitions on both (see appendix).

Interpreted on the basis of the number of correct definitions given, the data show a slight advantage on the side of the non-seeing child. However, it must be remembered

that these children were only blindfolded for this test; they had visual experience which gave them verbal reality for the words defined. The opposite is true in the case of the actually blind child; he is not visually familiar with the objects he is asked to define and if he is not at least acquainted with them through the sense of touch, his definitions have verbal unreality. Moreover, it is probably true that the blind child does not accumulate his vocabulary as early as the seeing child, and especially is this true in reference to abstract words. An issue could very probably be made of the question as to whether or not word definition should be included at all in mental testing scales for the blind.

7. TAPPING

The tapping test, which appears only in the Hayes scale, is placed in year VI where the subject is asked to count an irregular series of 4 to 6 taps, and in year X where he must count an irregular series of 9 to 12 taps (7).

Forty-nine subjects either took tests at both the VI and X year levels, or took the test in year X, success in the test at the VI year level being assumed by a basal age above the VI year level. Successes and failures are treated in relation to the highest test passed on the mental scale.

Nine subjects failed to pass the tapping test at year VI; the highest tests passed on the mental scale by these subjects were as follows:

TABLE I

No. of Subjects	Highest Test Passed
1	VII: 4
1	VIII: 3
2	VIII: 5
1	VIII: 6
1	IX: 2
1	IX: 5
1	X: 4
1	X: 5

Nine subjects passed the tapping test at the VI year level; the highest tests passed by them were:

TABLE II

No. of Subjects	Highest Test Passed
1	VIII: 3
1	VIII: 5
1	X: 2
1	X: 4
2	X: 5
1	XII: 4
1	XII: 7
1	XVI: 4

Thirty-one subjects had a basal age higher than year VI and were assumed to have passed the tapping test in that year. Out of that number 16 subjects passed their highest test above the XII year level, distributed as follows:

TABLE III

No. of Subjects.	Highest test passed
2	XIV: 2
1	XIV: 3
1	XIV: 4
1	XIV: 5
2	XVI: 3
1	XVI: 6
1	XVIII: 2
2	XVIII: 3
2	XVIII: 4
2	XVIII: 5
1	XVIII: 6

Twenty-nine subjects out of a total of 49 taking the tapping test in year X failed. Out of the 29, only 11 succeeded in passing tests in Year XII or above; they are:

TABLE IV

No. of Subjects	Highest test passed
2	XII: 4
1	XII: 5
3	XII: 7
2	XII: 8
1	XIV: 3
1	XVI: 4
1	XVI: 6

Twenty subjects passed the tapping test at Year X and 14 of that number passed their highest test in either Year XIV, XVI or XVIII. The distribution:

TABLE V

No. of Subjects	Highest test passed
2	XIV: 2
1	XIV: 4
1	XIV: 5
2	XVI: 3
1	XVIII: 2
2	XVIII: 3
2	XVIII: 4
2	XVIII: 5
1	XVIII: 6

Examination of the tables shows a close relation between successes and failures on the tapping test and achievement on the other tests of the scale. In the case of the successes the subjects generally succeeded on tests at the higher age levels; in the case of failures the highest test passed was generally in the lower age levels. On the basis of this relationship, the tapping test is validated in its inclusion in the Hayes scale and its position at the two age levels.

8. KNOX CUBE LINES

The Knox Cube lines, a second test that appears only in the Hayes adaptation, involves touching the four finger tips of the subject with the rubber tip of a pencil in a variety of orders. The subject then touches his fingers, using the other hand, in the same order that they were touched by the examiner. Lines B,C and D are placed in year X; lines E, F and G in year XII, and lines H, I and J in year XVIII (7).

Forty-eight subjects were given the test on the Knox Cube lines, 3 of that number having been assumed to have passed lines B, C and D by a basal age above year X. Thirty-eight of that number passed the test at year X, while 10 subjects failed. Nineteen subjects passed the test at both year X and XII, while 29 subjects failed at year XII. Only three out of the 48 subjects succeeded at year XVIII.

Eight out of ten 10-year-olds passed the test at the 10 year level. Of these ten subjects, 5 were of normal I.Q.

for their age, 4 were below normal and only one was above normal. Likewise, 7 out of twelve 12-year-old subjects passed the test at the XII year level. Of these twelve subjects, 4 were of normal I.Q. for their age, 3 were below normal, while 5 were above normal. Only three subjects passed the test at the XVIII year level and of these three 1 had a normal I.Q. for his age, while the other two were above normal.

These data would indicate that at least at years X and XII the Knox Cube lines have been correctly standardized. Nothing can be said as to standardization at year XVIII because no 18-year-old subjects were included among those tested, thereby causing a subsequent lack of data on this test.

Failure in the Knox Cube lines was due in many cases to poor localization in the fingers. The blindfolded subjects often groped on the surface of the table before coming in contact with their fingers. One boy even localized the touch on the examiner's hand. In other cases, failure seemed to be due not so much to faulty localization as to an inability to remember the order in which his fingers were touched.

VI. COMPARISON OF 114 BLIND I.Q.'S ACCORDING TO HAYES AND TERMAN SCORING

In a circular letter sent out to all persons using the Hayes Revision for the blind, Dr. Hayes himself reported that various testers familiar with the use of Terman's tests with seeing children found that the 1923 Revision of the Terman - Binet tests for use with the blind gave I.Q.'s that were too high; that is, that blind children with high I.Q.'s do not compare with seeing children of similar I.Q.'s in the quality of work, especially in high school. In the 1923 Revision an attempt was made to keep the arrangement of tests as close as possible to Terman's so that comparisons of the blind and seeing might be made. But there were many tests which could not be given without vision so that in order to present six tests for each year group it was necessary to introduce various new tests for which no seeing norms were available. To meet the difficulty a "Comparison Sheet" (see next page) was printed. A comparison was made of 4 tests at each year level which are nearly identical for the blind and seeing. Wherever possible Terman's starred tests, a shorter series, were selected. Only such tests as were considered equally fair for both blind and seeing were included, taking tests not more difficult for the blind because of their more limited life experience. This last point is offered by Dr. Hayes in partial explanation of the fact that in every year group except the first, one of Terman's tests had to be moved into

SAMPLE.

Sheet for comparison of blind and seeing on Binet Tests. 1926

Name...M.K..... School or city....Perkins.....
Examiner..P.B... Date..11/20/28.....

Chron. age yrs..19.mos.4; basal age X yrs; mos...
Mental age years...11; mos...6...
Degree of blindness R..L..Age at loss of vision..shortly after birth.

Blind I.Q.

III. 4 tests x 3
Terman 1 points
" 2 objects
" 6 Sentences
" Alt. 3 digits 1/3

IV. 4 tests x 3
Terman 1 lines
" 5. Sleepy
" 6 4 digits 1/3 120
" Alt. Sentences

V. 4 tests x 3
Terman IV. 3 Pennies
" 1 Weights
" 6 Commiss. 18
" Alt. Age

VI. 4 tests x 3
Terman V. 4 Use
" 1 R. hand
" 4 Raining
" 6 Sentences 6
144
12

VII. 4 tests x 3
Terman VI. 3 pennies
" L. Fingers M.A.12
" 3 5 digits 1/3 C.A. 16
" Alt. Days

Blind I.Q.76

VIII. 4 tests x 3
Terman VII 5 Differ
" 2 20 - 1
" 3 Broken
" 5 Sup. Def.

Basal age in months 120
deduct 3
117
Add 21
12 / 138

IX. 4 tests x 3
Terman VIII 6 voc.20
" 1 Date
" 3 change
" 4 4 digits 1/3

X. 4 tests x 3
Terman IX 6 Rhymes +
" 4 read mem. +
" 6 60 wds. + 117
" Alt. 6 digits 1/2 +

XII. 4 tests x 6
Terman X 1 Voc. 30 + 3
" 5 fables + 6
" 6 5 digits bd 1/3 + 6
" 8 snake, etc. -

XIV -4 tests x 6
Terman XII 1 Voc. 40 -
" 3 Pres -
" 5 Arith -
" Alt.7 digits 1/2 + 6
138 mo.

XVI. 4 tests x 7 1/2
Terman XIV. 1 Voc.50
" 2 Fables (8)
" 4 Boxes
" 5 6 digits 1/3 *

Special Abil

XVIII. 4 tests x 9
Terman XVI 1 voc.65 -
" 3 8 digits 1/3 + Spec.
" 4 Passages -
" 6 Ingenuity -

Terman 1 Voc. 75
Irwin 9 digits 1/3 -
" 7 " bk.1/3 + Spec.
" 8 " bk.1/3 -

Binet M.A. 11 years, 6 mos.
C.A. 16
I.Q. 72

the next higher group because of the small per cent passing in the lower group.

By means of this comparison a blind Binet I.Q. may be obtained in the regular way, that is, by dividing the mental age by the chronological age with 16 years as a maximum. Dr. Hayes further points out in his letter that to obtain a Terman-Binet I.Q. for the blind additional calculation is necessary, as follows:

For subjects with a basal age from 5 - 10 years inclusive, 3 months is deducted from the total mental age, since one test of a lower group is included in each of the year groups up to X, and appropriate amounts for higher tests passed are added (3 months for vocabulary, 30 words, which is a X year test in Terman, 6 months for each of the other XII year tests, et cetera).

For subjects with a basal age of 12 or 14, 6 months is deducted from the total mental age and appropriate amounts added for higher tests passed. It must be noted that in year groups XII, XIV, XVI and XVIII the transposed test has a lower value than the others of the group.

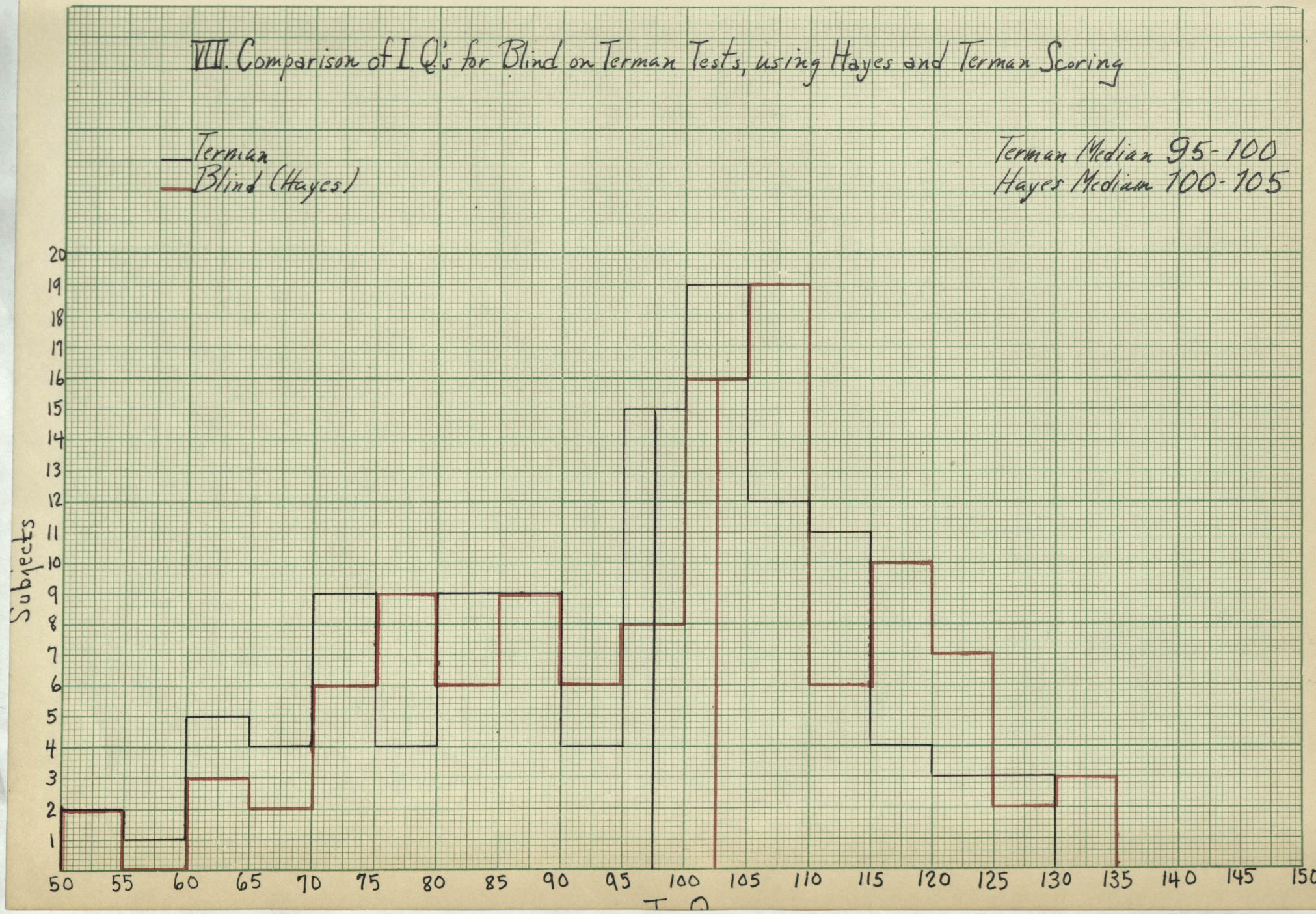
For subjects passing all the tests in years XVI or XVIII, a basal age of 14 years is used. For subjects with a basal age of 16, 168-6-162 months is credited and 6 months for vocabulary, 50 words, and 22 1/2 months for the other three tests of the 16 year group is added. If further tests have been passed in the XVIII year level, 7 1/2 months for vocabulary, 65 words, and 9 months for any other test passed

is added.

Such pairs of I.Q.'s have been worked out for the 114 blind subjects tested in the first series (see appendix). The comparison merely shows the effect of shifting the tests in the Hayes Revision and is a statistical way of finding the same thing that was shown by a comparison of blind I.Q.'s on the Hayes and Terman scales. However, the comparison of I.Q.'s, as set forth on the "Comparison Sheet", will make all Hayes I.Q.'s higher than Terman I.Q.'s, whereas in actually giving both tests such is not the case.

A comparison of the Hayes and Terman scoring for 114 blind cases may be seen on graph VIII. Terman scores are seen to be in greater number at the lower end of the I.Q. distribution, while the Hayes scores are in greater number at the upper end of the I.Q. distribution. Actual medians show 5 I.Q. points difference, the median for the Terman distribution falling between 95 - 100 I.Q. points and that for the Hayes between 100 - 105 I.Q. points. The Hayes scores also gain 5 I.Q. points at the upper end of the I.Q. distribution. These data coincide with results obtained in the comparison of blind I.Q.'s on the Hayes and Terman tests in the first series, the medians for the two comparisons being identical.

The average increase for each subject on the Hayes scoring as opposed to the Terman scoring is 3.85 I.Q. points. As this average increase of 3.85 I.Q. points represents a gain derived wholly from elevating tests to a higher year


VIII. Comparison of I.Q.'s for Blind on Terman Tests, using Hayes and Terman Scoring
Terman
Blind (Hayes)
Terman Median 95-100
Hayes Median 100-105
Subjects
I.Q.
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125 130 135 140 145 150

level in the Hayes scale than the year level at which the same tests are found in the Terman scale, it is wholly doubtful that this increase in I.Q. for the blind can be justified. The question again arises as to whether or not there is any scientific advantage in thus compensating for possible retardation of the blind subject by arbitrarily raising his psychological test scores. A discussion of this problem and similar ones will follow.

In 1927, Hayes gathered I.Q.'s for 300 blind children tested in eastern schools. The Binet I.Q.'s, which were calculated for the blind as for the seeing, showed a median I.Q. of 88 - 89. Blind I.Q.'s, which were calculated with some tests moved lower, showed a median I.Q. of 92 - 93. Here again the transposition of tests in the year levels shows an advantage in average I.Q. scores for the blind. The correlation between the two distributions is -.839.

VII. INTERPRETATION AND SUMMARY

1. Interpretation

A discussion of several problems which were stated in the introduction, but which have been barely mentioned in the treatment of statistical data, will follow. These problems are closely related to any evaluation of intelligence tests for the blind.

Through statistical treatment this study has shown that Hayes test scores for the blind tend to be higher than Terman test scores. If the assumption is made that the average blind child is retarded, what is the scientific advantage in thus revising his psychological test scores? Practically, there can be no advantage in any revision of I.Q.'s for the blind. Educational training aims primarily to fit the blind child to take his place as an economically independent member of society. Necessarily, in this society he must compete not with the blind but with the seeing. Raising his I.Q. will not aid the blind subject in his ultimate success or failure in this competition. Rather such compensation will be more apt to harm him; he will either be over-rated in intelligence, which will not in any way aid him in making his own way, or he will not be stimulated sufficiently to provoke the best performance of which he is capable. The latter is most important for on it depends his ultimate success of failure in the practical test of meeting competition in society.

Retesting of subjects at frequent intervals in schools for the blind shows a steady gain in I.Q., whereas actually the subjects are not becoming more intelligent. The situation recurring most often is that the blind child is reared in the home until he is 9 or 10 years old, when he enters a school for the blind. Here the students are all given the same kind of training and the items of the mental test are built upon this institutional training. What the student has learned before entering the school is not measured on the test. The longer the student is in the institution, the more he conforms to the test, and, consequently, his I.Q. goes higher. Moreover, I.Q.'s for the blind tend to increase more quickly than I.Q.'s for the seeing, due to the fact that the seeing child grows up in the environment which the Terman-Binet test assumes, so his I.Q. remains about the same.

Often the tendency is for the blind subject to leave the school for the blind after Braille is learned and go into a school for the seeing. With any revision of his I.Q., he is over-rated as far as I.Q. is concerned both in his new environmental situation and in comparison with his seeing classmates. On the other hand, if a seeing child were to lose his sight at the age of ten or twelve years and enter a school for the blind, his seeing I.Q. would be under-rated in his new environment and in comparison with his classmates.

Previous description of the Hayes tests has shown that these tests are adapted from tests for seeing children. The Terman-Binet scale assumes that standardization has included

the range of environments for the seeing child. The question arises as to whether it can be assumed that the environment of the average blind child is equivalent to that assumed in the Terman-Binet test; that this assumption is made in any attempt to adapt tests for the blind from those for the seeing is self-evident. But such an assumption can hardly be justified. Cutsforth (2,Chap. I) points out that the blind child is from infancy egocentric and that strong external stimulations are necessary if he is to be brought into intimate relationship with his social environment. In addition, Cutsforth (2, Chap. III) states: "Neither the seeing nor the blind fully realize the difference which exists between their respective worlds of experience and reality. The seeing are scarcely aware of the fact that the greater part of their lives consists of visual experience, employing visual form, size, color, brightness, movement and spatial distance. The blind are taught these concepts and how they are employed, and with verbal mastery of them, a workable parity appears to have been established between the seeing and the blind.

"This unique social and educational situation in which the blind are placed, creates the necessity of treating a vast world of unreality in some realistic manner. This necessity has produced the much discussed verbal-mindedness of the blind." Only full realization on the part of educators of the blind of these differences in the environments of the blind and seeing which Cutsforth describes will put an end

to the folly of adapting methods from the seeing for use with the blind.

An historical view of the first attempts at educating the blind likewise stresses the mistake of modeling such education upon established educational methods for the seeing. Valentin Hauy, who established the first school for the blind in Paris in the 18th century, discarded much of the apparatus of his predecessors and adopted simpler devices more in accord with the processes used in the teaching of normal children. French (3, p. 28) points out this fact as the fundamental fallacy of Hauy's system of teaching the blind and of the work of his successors. Far from fitting education to the condition and limits of the blind, Hauy tried to fit his pupils to the conventions and traditions of seeing persons. The fallacy, according to French, lay in thinking that touch became a substitute for sight, when in fact the touch sense remains just what it had always been. The assumption was made that what looks well to the eye must appeal equally to the finger tips.

Similar mistakes can be found during the growth of the educational movement for the blind. French (3, p. 48) continues: "In 1832, the Scottish Art Society offered a prize for the best and most practical system of embossing for the blind. The Director of the Glasglow Institute set as a criterion of judgment that a purely arbitrary system must not be adopted nor too wide a departure from the Roman accepted as the tendency would be in either case to isolate

the blind." That Braille's system of symbols, with its scientific basis for use with the blind, has been the most adequate method to date for teaching the blind to read is proof enough of the futility of attempting to adapt methods from the seeing for use with the blind (3, p. 49).

Thus the conclusion is reached, upheld by historical precedent, that a satisfactory intelligence scale for the blind cannot be adapted from similar scales for the seeing. Peterson's (8, p. 146) discussion of the Binet-Simon tests states that "Binet's extensive testing of his two daughters, results of which were published in 1902 in a separate volume entitled The Experimental Study of Intelligence was doubtless a most important step in his preparation for the later construction and establishment of the intelligence scale." Later, Binet gave tests to thousands of school children of all ages, standardizing each test at the year level where 65 per cent of the children of that age were successful with it. An obvious suggestion presents itself. Rather than adapting mental tests for the blind - if there must be such tests - from mental scales for the seeing, the mental development of the blind child must be studied in relation to his social environment and a scale of mental tests formulated on that basis. Any other methods will be liable to errors of standardization and may be criticized on the grounds of lacking scientific approach.

Are the home and social environments of different blind children sufficiently similar to warrant a uniform mental

test for all? As the blind are a heterogeneous, rather than a homogeneous, group the answer is in the negative. Blind subjects differ among themselves in their acquaintance with their environment, both objective and social. They differ in knowledge of verbal meanings and in manipulation of their environment. A wide variation is found among blind children who have brothers and sisters and those who have grown up entirely among adults. Moreover, in any class of defectives, the classification is usually found to take in a great many other defects. In arranging a uniform mental test for the blind it is impossible to recognize all these physical and environmental factors.

A particularly striking example of a case in which application of a uniform intelligence test would be valueless is found in "A Case of Retarded Development in the Blind" (12a, p. 188) reported by Cutsforth. Bert, partially blind from birth, was cared for by his parents, - who refused to relinquish care of him - and did not see the inside of a school room until he was 24 years old, when he was sent to a special institution. At that time, he was more helpless and unadjusted to his condition than those who had only recently lost their sight. His appearance, mannerisms and general behavior were most objectionable. He had many physical defects, as well as speech defects. He was solitary and unsocial and showed little interest in his school work; he did enjoy reading, employing what little sight he possessed, and playing the piano. On the Hayes test, he made a mental

age of 11 years and 2 months. His ability was best in rote memory and verbal processes; he failed all tests requiring motor co-ordinations. Cutsforth believes that it does not help to understand Bert's condition merely to classify him as feebleminded. Bert must be studied in relation to the environment in which he grew up, since the conditions of social environment determine the development of all phases of personality. His home failed to produce two vital conditions; it failed to provide objectives, attainment of which would have expanded his environment, and it failed to allow stimulations to occur which would have made it possible for Bert to perceive objectives as remote from his immediate situation.

The only probable justification for a uniform mental test would be on the assumption that a majority of blind children now receive educational training in special classes or institutions for the blind and that this training is sufficiently similar to offset early environmental variations.

However, the practical value of I.Q. ratings for the blind cannot be denied. An intelligence test for rating the blind within their own group would certainly offer advantages to educators, although its usefulness in comparing the blind with the seeing would be doubtful. The I.Q. rating supplies an objective criterion of judgment, as opposed to a subjective judgment which is always more open to error.

The Hayes Revision may also be criticized for its extensive use of verbal tests and exercises. Cutsforth (2,Ch.I)

states that the verbal-mindedness of the blind has long been recognized. He discusses verbalism at length and points out that many words, especially abstract words, have verbal unreality for the blind child. But verbalism, Cutsforth says, will "organize the child's first social responses, and will encourage the use of vocalization for self-stimulation. At a later stage of development, the child will reproduce this constant conversation for himself in the form of meaningless jingles and nonsense phrases." As a socializing factor, then, verbalism has its uses but as a basis of judgment of achievement it is liable to errors. Too often, the blind child, having adopted the speech of his seeing teachers and companions, will use words that are meaningless to himself. The examiner has no objective criteria for knowing what content of the verbal answer is meaningful to the subject so the value of such an answer is doubtful. It follows that with the inclusion of too many verbal tests in the Hayes Revision there are too few manual performance tests.

It was suggested in the special sutdy of coins under part V that an effort should be made to keep the items in the mental test scales abreast of social changes. There, a boy who laughed when given a silver dollar, saying that he had seen only three in his life, and a girl who identified the dollar as a "compact" were cited. An additional case points out this necessity. In year X: 2 in Terman (10) and in year XII: 5 in Hayes (7) is located the absurdities test.

The subject is asked to tell what is foolish about five different statements, one of which is "There was a railroad accident yesterday but it was not very serious. Only 48 people were killed." One 9-year-old boy replied, "It means it's just ordinary because people are always getting killed every day.". His answer is another example of the change of the times. He has grown up in the midst of a society whose newspapers report daily a growing number of automobile and airplane fatalities; consequently, he attaches less significance to the loss of human life.

In connection with the verbalism of blind subjects, it was noted that the seeing child blindfolded tended to stimulate himself by talking and to give more irrelevant answers than when allowed the use of vision. This tendency was exhibited most clearly in the test for naming the days of the week in year VII (7) (10) and finding rhymes in year IX (7) (10). Seeing subjects blindfolded were inclined to continue to repeat the days of the week over and over until stopped by the examiner; similarly, the key word for rhyming was changed more often. As an example, rhymes for "day" became ray, say, Sunday, Monday, candy, sandy, and the like.

2. General Summary

Data gathered in this study indicate the following conclusions concerning the Hayes Revision for testing blind subjects:

(1) That the Hayes Revision of the Terman-Binet scale for blind subjects is standardized on the average 12 + I.Q. points above the Terman-Binet scale for seeing subjects.

(A) Distributions and scatter show the Hayes scale to be standardized higher than the Terman in both the lower and upper age levels.

(B) Both blind and seeing subjects tend to have higher I.Q.'s on the Hayes scale than on the Terman scale.

(2) That transposition of tests from a lower age level in the Terman scale to a higher age level in the Hayes scale gives arbitrarily a slight advantage in I.Q. to the Hayes subjects.

(A) Comparison of I.Q.'s obtained according to Hayes and Terman scoring show this increase in I.Q. for each subject to average 3.85 I.Q. points.

(3) That compensation by raising the psychological test scores of the blind is neither justified nor to be desired.

(4) That a satisfactory intelligence scale for the blind cannot be adapted from similar scales for the seeing,

for the environments of the blind and seeing are too dissimilar.

(5) That a uniform mental test for all blind subjects is of doubtful value, due to wide environmental variations within the group.

(6) That the Hayes Revision may be criticised for its extensive use of verbal tests and exercises, while too few manual performance tests are included.

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APPENDIX

In the following group of tables will be found more detailed data supplementing the material already presented in the discussions of experimental results;

I. TABULATIONS OF 114 SUBJECTS AND THEIR I.Q.'S FOR FIRST SERIES OF TESTS; STATE SCHOOL FOR BLIND, KANSAS CITY, KANSAS

TABLE I

12 Subjects Showing Increase of More Than 5 I.Q. Points on Terman Test over Hayes Test

Subject	Hayes I.Q.	Terman I.Q.	Difference
R.B.	131	139	8
L.B.	116	122	6
D.B.	102	108	6
M.G.	103	109	6
E.K.	118	127	9
C.L.	104	110	6
M.M.	71	79	8
D.R.	113	120	7
J.S.	112	122	10
L.S.	91	104	13
L.W.	106	113	7
F.W.	95	105	10

Average Difference - 8

TABLE II.

37 Subjects Showing Same I.Q. on Both Hayes and Terman Tests within Spread of 10 I.Q. Points - 5 points up or Down.

Subject	Hayes I.Q.	Terman I.Q.	Difference
D.A.	121	120	1
M.A.	107	108	1
G.B.	105	107	2
L.B.	113	108	5
T.B.	117	113	4
E.B.	94	92	2
H.C.	101	106	5
G.C.	77	72	5
D.C.	73	70	3
P.G.	80	78	2
A.H.	95	94	1
C.H.	118	118	0
I.H.	100	100	0
A.J.	122	122	0
W.J.	118	118	0
D.K.	113	116	3
S.M.	103	98	5
B.M.	82	78	4
R.M.	93	88	5
R.Mo.	115	114	1

TABLE II (Cont)

Subject	Hayes I.Q.	Terman I.Q.	Difference
R.Mu.	109	108	1
T.M.	115	114	1
J.M.	116	115	1
V.N.	66	65	1
C.P.	99	100	1
W.P.	75	71	4
E.R.	104	100	4
D.R.	60	55	5
H.R.	82	79	3
J.R.	96	99	3
L.S.	104	104	0
M.S.	78	79	1
L.T.	99	100	1
J.U.	112	108	4
A.W.	94	91	3
J.W.	63	65	2
A.Wy.	109	107	2

Average Difference - 2 +

TABLE III

65 Subjects Showing Decrease of More Than 5 I.Q. Points on Terman Test Over Hayes

Subject	Hayes I.Q.	Terman I.Q.	Difference
I.A.	71	60	9
J.B.	88	75	13
D.B.	106	95	11
W.B.	118	102	16
M.B.	117	107	10
A.B.	73	65	8
I.B.	92	86	6
B.B.	119	101	18
E.B.	76	60	16
M.Be.	137	117	20
C.B.	100	89	11
V.B.	126	113	13
O.B.	120	113	7
H.C.	59	52	7
L.B.	118	107	11
V.Be.	109	103	6
C.Bl.	119	100	19
M.Ba.	81	75	6
A.C.	79	59	20
G.D.	104	84	20
J.D.	79	63	16
E.E.	113	100	13

TABLE III (Cont)

Subject	Hayes I.Q.	Terman I.Q.	Difference
M.G.	87	73	14
L.H.	106	72	34
C.H.	107	87	20
N.H.	116	103	13
K.H.	115	108	7
R.H.	107	89	18
G.H.	130	107	23
V.I.	106	87	19
J.J.	72	54	18
R.K.	113	105	8
W.K.	100	90	10
H.K.	74	67	7
W.Kr.	92	84	8
J.K.	72	61	11
V.K.	95	89	6
F.L.	107	100	7
T.M.	115	101	14
F.M.	107	101,	6
E.M.	81	56	25
A.M.	126	94	32
L.M.	137	119	18
E.M.	82	75	7
C.M.	108	84	24
C.Mc.	115	105	10

TABLE III (Cont)

Subject	Hayes I.Q.	Terman I.Q.	Difference
J.M.	95	79	16
D.M.	89	81	8
E.N.	112	105	7
D.O.	112	93	19
M.O.	94	84	10
M.P.	100	66	34
W.R.	91	85	6
L.S.	131	120	11
A.S.	109	100	9
I.S.	118	107	11
M.S.	110	69	41
R.S.	111	96	15
J.V.	143	126	17
E.W.	115	100	15
L.W.	120	91	29
L.Wa.	104	94	10
F.W.	107	86	21
M.W.	80	74	6
S.W.	107	100	7

Average Difference - 14 +

II. TABULATIONS OF 54 SUBJECTS AND THEIR I.Q.'S FOR SECOND SERIES OF TESTS; TONGANOXIE, KAN., GRADE SCHOOL

TABLE IV

6 Subjects Showing Increase of More than 5 I.Q. Points on Terman Test over Hayes Test.

Subject	Hayes I.Q.	Terman I.Q.	Difference
F.A.	73	97	24
L.G.	77	92	15
J.M.	139	145	6
R.O.	84	107	23
D.R.	67	75	8
T.W.	120	127	7
		Average Difference -	13+

TABLE V

26 Subjects Showing Same I.Q. on both Hayes and Terman Tests Within Spread of 10 I.Q. Points - 5 points up or down.

Subject	Hayes I.Q.	Terman I.Q.	Difference
M.Bo.	108	109	1
M.B.	112	108	4
W.B.	76	81	3
C.B.	71	66	5
O.C.	104	109	5
B.C.	74	77	3
H.C.	83	82	1
E.C.	93	95	2
F.D.	61	59	2
M.F.	123	123	0
M.H.	86	87	1
M.K.	100	103	3
D.K.	84	87	3
F.K.	81	82	1
B.L.	97	95	2
C.L.	121	120	1
C.La.	88	85	3
D.L.	142	137	5
L.L.	60	58	2
D.Lo.	63	64	1
M.M.	107	108	1
J.N.	105	102	3

TABLE V (Cont)

Subject	Hayes I.Q.	Terman I.Q.	Difference
W.P.	64	67	3
W.R.	67	67	0
F.T.	76	80	4
D.W.	67	71	4
		Average Difference	- 2 +

TABLE VI

22 Subjects Showing Decrease of More Than 5 I.Q. Points on Terman Test over Hayes

Subject	Hayes I.Q.	Terman I.Q.	Difference
I.A.	105	98	7
R.B.	105	92	13
C.C.	85	79	6
V.C.	102	88	14
D.D.	112	104	8
A.F.	83	77	6
H.H.	116	108	8
D.K.	114	100	14
M.K.	68	55	13
B.L.	83	74	9
E.L.	100	88	12
R.M.	93	81	12
C.M.	111	105	6
D.M.	123	101	22
M.M.	122	107	15
H.M.	119	100	19
E.N.	108	95	13
E.P.	113	107	6
H.R.	99	93	6
G.S.	112	105	7
R.W.	138	132	6
L.W.	127	120	7
		Average Difference -	10 +

TABLE VII

Number of Correct Definitions Given by 53 Subjects on the Vocabulary Tests in Hayes and Terman Scales

Subject	Hayes	Terman
F.A.	12	17
I.A.	18	12
M.B.	20	22
M.Bo.	10	14
C.B.	6	6
W.B.	0	6
R.B.	26	24
O.C.	4	6
B.C.	0	3
C.C.	9	8
H.C.	0	6
V.C.	16	9
E.C.	13	9
D.D.	20	21
F.D.	10	10
A.F.	17	12
M/F.	21	26
L.G.	0	3
M.H.	0	5
H.H.	10	6
M.K.	15	12
D.K.	16	14

TABLE VII (Cont)

Subject	Hayes	Terman
D.Kn.	6	8
F.K.	5	5
M.K.	10	10
B.L.	7	11
C.L.	22	24
C.La.	14	11
B.La.	13	15
L.L.	8	13
D.L.	33	28
E.L.	21	17
D.Lo.	13	9
J.M.	23	25
R.M.	7	7
C.M.	26	21
D.M.	17	12
M.M.	17	11
H.M.	11	9
M.Mi.	12	10
J.N.	14	10
E.N.	10	13
R.O.	0	3
E.P.	20	18
W.P.	10	7
W.R.	10	5

TABLE VII (Cont)

Subject	Hayes	Terman
H.R.	20	12
J.S.	8	5
F.T.	19	18
R.W.	36	31
T.W.	18	20
D.W.	16	15
L.W.	4	4

TABLE VIII

Comparison of I.Q.'s According to the Hayes and Terman Scoring on Comparison Sheet for 114 Blind Subjects.

Subject	Hayes Scoring	Terman Scoring	Difference
D.A.	121	112	9
M.A.	97	94	3
I.A.	84	65	19
W.B.	117	113	4
J.B.	88	84	4
D.B.	102	100	2
R.B.	132	127	5
M.B.	100	97	3
A.B.	63	61	2
G.B.	101	100	1
I.B.	87	85	2
L.B.	118	113	5
L.Bl.	112	108	4
B.B.	122	117	5
E.B.	76	72	4
T.B.	109	105	4
M.Be.	114	111	3
C.B.	93	89	4
V.B.	129	125	4
D.B.	109	105	4
O.B.	122	118	4

TABLE VIII (Cont)

Subject	Hayes Scoring	Terman Scoring	Difference
L.Bo.	106	103	3
E.Br.	92	89	3
H.C.	53	51	2
R.K.	109	105	4
V.Bu.	107	103	4
C.Bl.	110	107	3
M.Ba.	78	74	4
H.Co.	88	85	3
G.C.	71	69	2
A.C.	75	71	4
D.C.	73	70	3
G.D.	100	97	3
J.D.	79	77	2
E.E.	109	106	3
P.G.	76	74	2
M.G.	110	105	5
M.Gu.	82	79	3
A.H.	94	88	6
L.H.	100	96	4
C.H.	101	97	4
N.H.	117	113	4
C.Ho.	121	117	4
K.H.	110	108	2
R.H.	101	97	4

TABLE VIII (Cont)

Subject	Hayes Scoring	Terman Scoring	Difference
I.H.	89	87	2
G.H.	125	122	3
V.I.	105	101	4
A.J.	122	112	10
J.J.	67	64	3
W.J.	117	113	4
W.K.	88	85	3
E.K.	117	113	4
D.K.	108	101	7
H.K.	78	74	4
W.Kr.	97	94	3
J.K.	67	65	2
V.K.	84	81	3
C.L.	105	102	3
F.L.	110	105	5
S.M.	99	95	4
M.M.	75	71	4
T.M.	113	108	5
F.M.	108	104	4
E.M.	79	76	3
A.M.	131	127	4
B.M.	73	70	3
L.M.	126	121	5
R.M.	90	87	3

TABLE VIII (Cont)

Subject	Hayes Scoring	Terman Scoring	Difference
T.M.	121	117	4
E.Mc.	77	73	4
C.M.	105	101	4
J.M.	113	110	3
A.Mc.	117	108	9
J.Mc.	96	93	3
R.M.	117	108	9
R.Mc.	108	104	4
D.M.	84	81	3
V.N.	65	62	3
E.N.	107	104	3
D.O.	113	108	5
M.O.	88	86	2
M.P.	92	90	2
C.P.	101	97	4
D.P.	73	70	3
B.R.	84	81	3
E.R.	105	101	4
D.R.	55	53	2
H.R.	82	79	3
D.Re.	109	105	4
J.R.	87	83	4
L.S.	118	115	3
A.S.	102	100	2

TABLE VIII (Cont)

Subject	Hayes Scoring	Terman Scoring	Difference
I.S.	108	104	4
L.Sk.	103	99	4
M.S.	76	73	3
M.Sm.	108	104	4
J.S.	117	112	5
R.S.	105	101	4
L.Sp.	92	88	4
L.T.	100	96	4
J.U.	117	114	3
J.V.	132	126	6
E.W.	112	108	4
L.W.	110	107	3
L.Wa.	104	100	4
F.W.	109	106	3
M.W.	78	75	3
S.W.	101	97	4
L.Wi.	103	100	3
A.W.	88	85	3
J.W.	61	60	1
F.Wr.	92	88	4
A.Wy.	103	99	4

Average Difference - 3.85