

8-23-1946

Standardization of the Bradley Tests and the Effects of Hypoglycemia on One Subject's Scores

Jim Mae Coy

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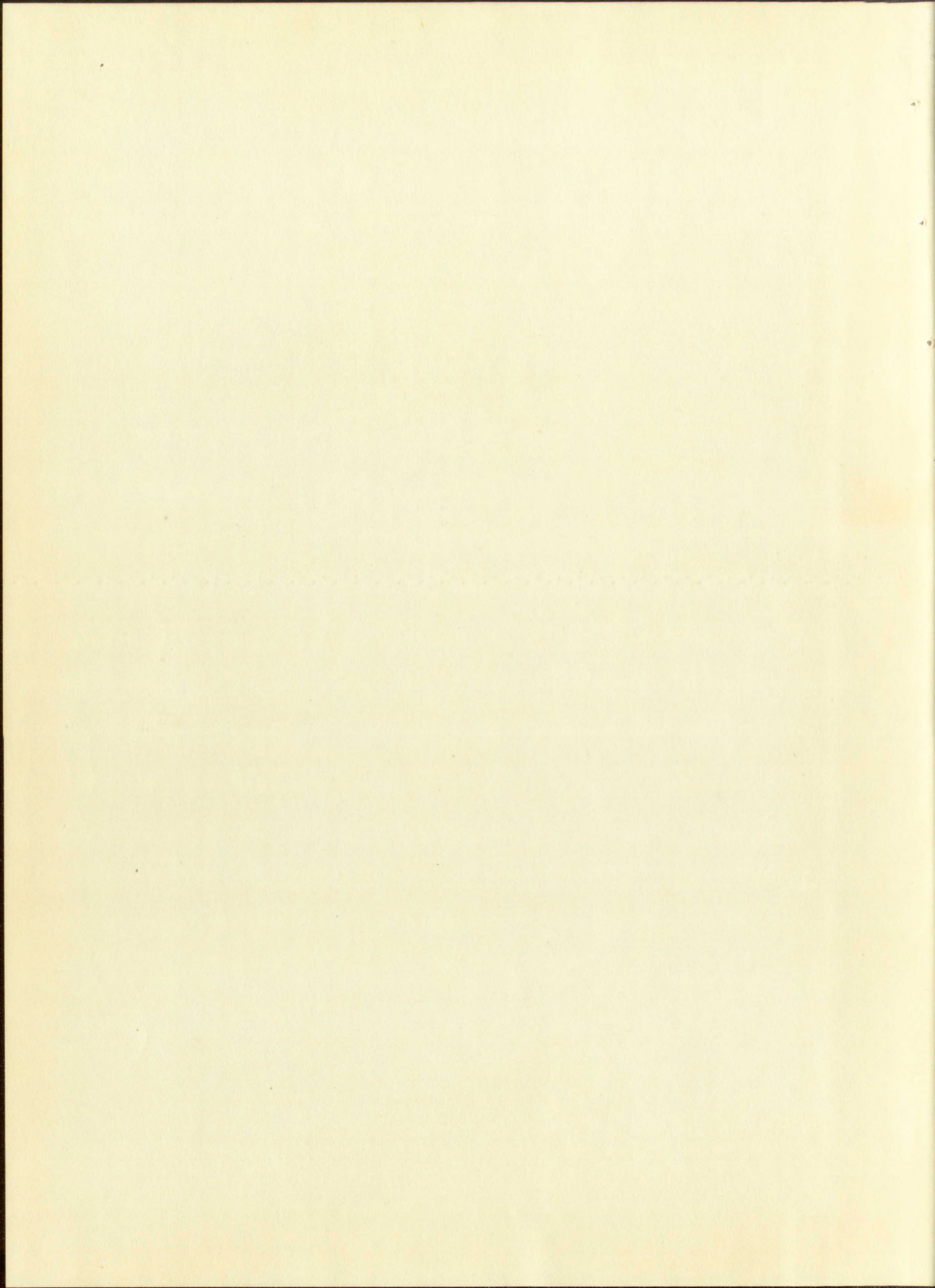
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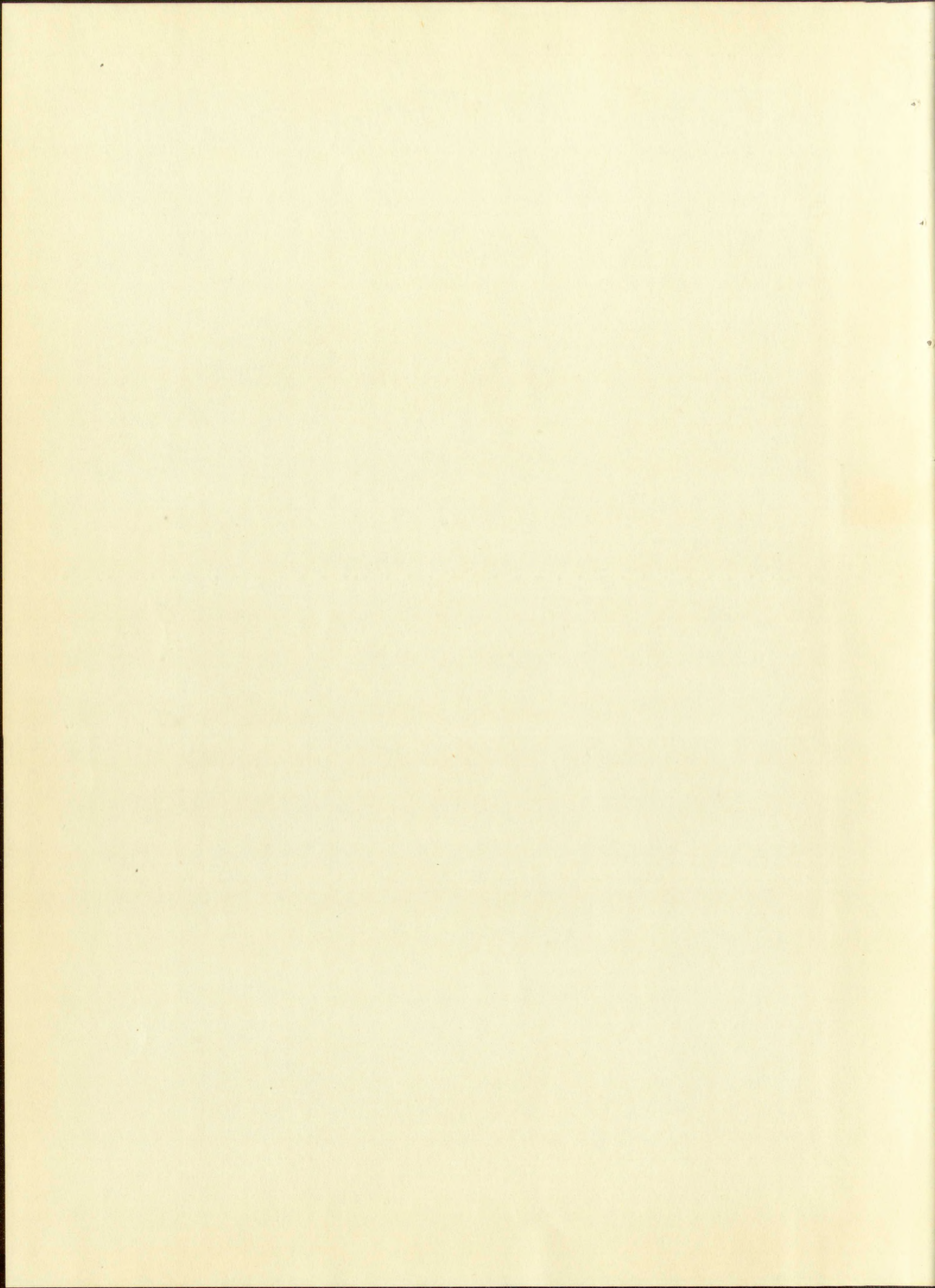
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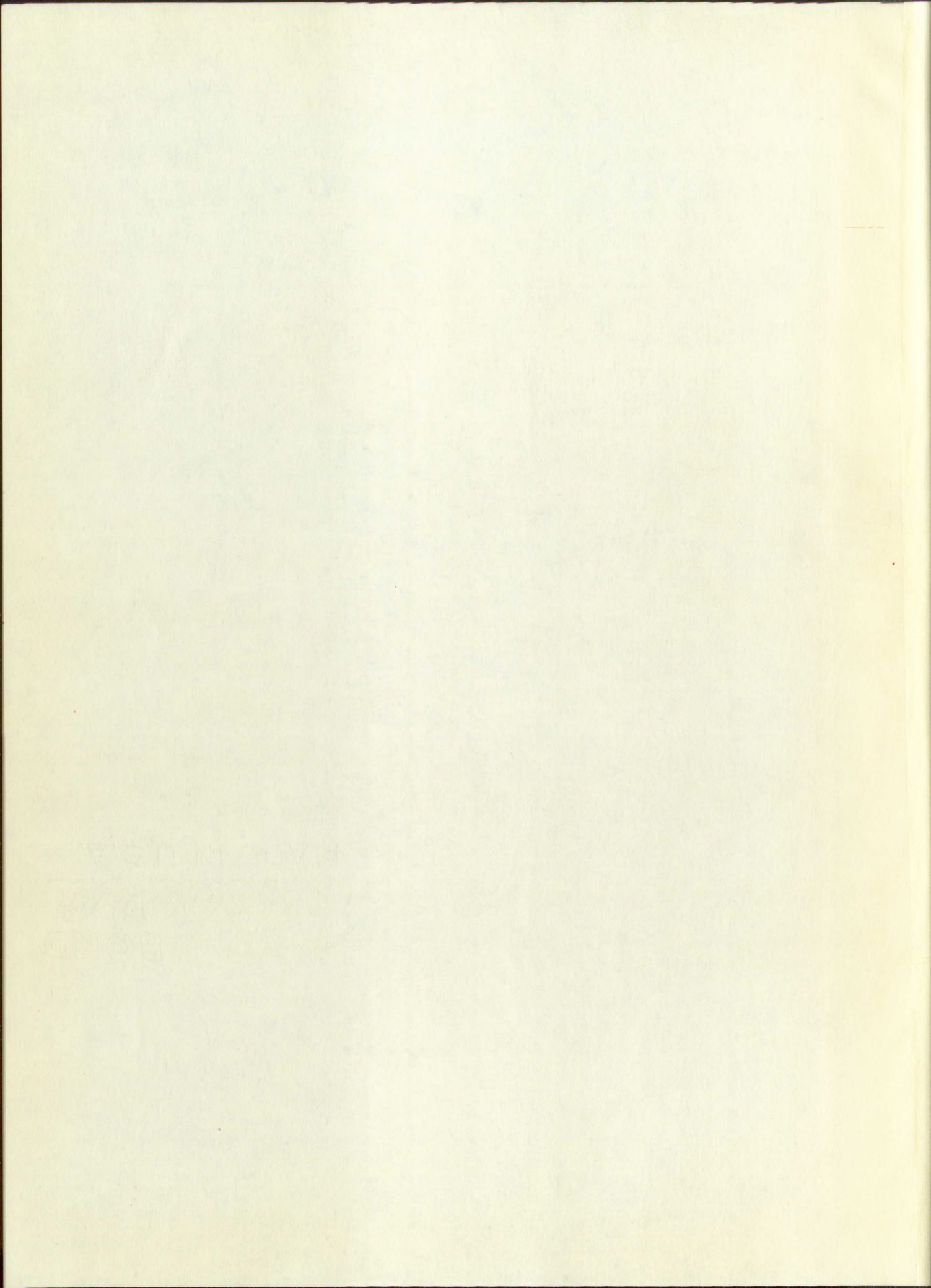
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STANDARDIZATION OF THE BRADLEY TESTS AND THE EFFECTS OF
HYPOGLYCEMIA ON ONE SUBJECT'S SCORES

A Thesis

Presented to

the Faculty of the Department of Psychology

University of New Mexico

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts in Psychology

by

Jim Mae Coy

June 1947

STATE DEPARTMENT OF THE DISTRICT OF COLUMBIA
OFFICE OF THE SECRETARY



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This thesis, directed and approved by the candidate's committee, has been accepted by the Graduate Committee of the University of New Mexico in partial fulfillment of the requirements for the degree of

MASTER OF ARTS

Harold D. Larsen

DEAN

August 23, 1946

DATE

Thesis committee

George Peterson

CHAIRMAN

Henry E. Garrett

Harold D. Larsen

This thesis, directed and approved by the candidate's com-
mittee, has been accepted by the Graduate Committee of the
University of New Mexico in partial fulfillment of the require-
ments for the degree of

MASTER OF ARTS

Charles P. Brown
1942

August 22, 1942
1942

Thesis committee

Richard L. Peterson
Chairman

Henry E. Garrett

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INTRODUCTION

In April, 1942, Captain Jack Bradley was captured by the Japanese on Bataan. Before entering the army, he had been a student at the University of New Mexico and had taken several courses in psychology. He was in his third year of undergraduate work when called into the service in 1940, along with other members of the well-known 200th Coast Artillery of the New Mexico National Guard.

In September, 1945, Captain Bradley was released from a Japanese Prisoner-of-War Camp and returned to this country, where for the past year he has been undergoing rehabilitation at the Bruns General Hospital in Santa Fe, New Mexico. During the period of his captivity, amounting to over three years, Captain Bradley underwent some of the most severe hardships that any man is ever asked to submit to. He is a tall strapping fellow of 195 pounds, but he reports that his weight fell off to about 135 pounds during captivity. His daily diet for this period averaged 1300 calories. This is considerably under what is regarded as necessary for adequate maintenance of life. It is well known, of course, that many of the prisoners did succumb and that most, if not all, of the survivors had the typical dietary deficiency diseases during most of their internment. We can surmise that his morale along with that of his fellow

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MEMORANDUM

DATE: 1/15/50
TO: THE SECRETARY
FROM: [Illegible]

In April, 1949, certain facts regarding the activities of the Japanese in Mexico were reported to the Secretary of the Interior. It was stated that the Japanese had been active in the University of the Pacific and had been engaged in various activities. It was also stated that the Japanese had been active in the University of the Pacific and had been engaged in various activities. It was also stated that the Japanese had been active in the University of the Pacific and had been engaged in various activities.

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prisoners must have been very low during most of his imprisonment.

Yet Captain Bradley returned to this country with an armload of material representing data he had collected on the mental ability of his fellow prisoners. Without access to standardized mental tests, he improvised his own. Without the help of a library, he drew solely upon his memory and ingenuity to devise problems. Without what is usually regarded as the necessary graduate training to carry on independent research, he depended on his zeal to carry on his investigation. Without the incentives ordinarily given to graduate students of earning an advanced degree, he continued this research program when he was uncertain whether he would survive to show it to anyone. He saw an opportunity to obtain some valuable scientific observations on changes in mental ability in men under a degree and duration of stress that is seldom encountered, and he seized it.

The results of his work are his story, and he should have the opportunity to tell it when and as he wishes. Meanwhile, Mrs. Coy, whose study follows, has used his problems on normal college students and graduates as a first step in their standardization. There may be some who will wonder why she used some kinds of material and omitted other kinds. The answer is that these are the problems Captain

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ment.

Yet Captain Radley returned to this country with an

airman of material reputation, and he had collected on

the mental ability of his fellow prisoners. With the access

to standardized mental tests, he improved his own. With-

out the help of a library, he drew solely upon his memory

and ingenuity to devise problems. Without what is usually

regarded as the necessary graduate training to carry on

independent research, he succeeded on his first try in

his investigation. Without the facilities ordinarily given

to graduate students of carrying on advanced studies, he suc-

ceeded in this research program and he was recognized as a

he would survive to show it to anyone. He was an opportu-

nity to obtain some valuable material in connection with

changes in mental ability in men under a restricted program

of stress that is seldom encountered, and he carried it

The results of his work are the result of his ability

have the opportunity to tell it again and so to others.

Meanwhile, Mrs. Cox, whose story follows, has used the pro-

lems on normal college students and presented as a final

step in their standardization. There may be some who will

wonder why she used some kind of material and related other

kinda. The answer is that these are the problems Captain

Bradley used. Inevitably some of the problems used will be better than others and some hardly suitable for mental tests. The wonder is that, under the circumstances, any of them were used or any other kind of work other than the business of keeping alive was accomplished among these prisoners of war. In carrying on Captain Bradley's tests, we at New Mexico are paying tribute to his fine spirit, and we hope he may find some of our results useful to him. This foreword is offered as an explanation to the reader of the work which follows.

George M. Peterson

University of New Mexico
1946

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II THE PRELIMINARY TESTS

III CRITICAL EVALUATION OF THE TESTS

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TABLE

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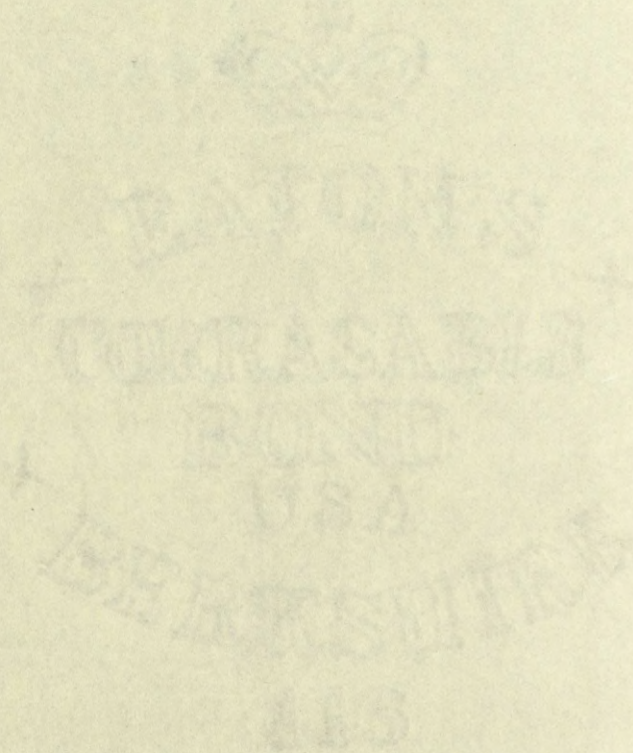
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ILLUSTRATION

1. Form Used for the Research Report
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CHAPTER I

THE PURPOSE AND SCOPE OF THE INVESTIGATION

This study may be conveniently described in two parts. In part one, a series of tests used by Captain Jack O. Bradley on his fellow officers during their imprisonment by the Japanese was given to a group of fifty college students and graduates. In part two, the tests were administered to one hypoglycemic subject, both in the normal and abnormal state. The norms obtained in part one were used in part two to determine standard scores for the hypoglycemic subject in order to compare his normal with his abnormal state.

Aside from this value of the norms for our special purpose, they may have additional value for Captain Bradley when he reports his results on the prisoners of war. For this reason, the group selected for standardization purposes was made as comparable to the officer group he used as common sense, in the absence of better information, could make it. The subjects, all males, were selected from superior students as indicated by entrance tests and grades at the University of New Mexico. Some were discharged veteran officers. A few younger faculty members were included. The range in age was from eighteen to forty-six years, with the majority falling between twenty-two and twenty-eight.

This study was experimentally designed in two parts. In part one, a series of tests were conducted by Jack O. Bradley on his fellow officers and their families. Comment by the Japanese was made on a group of fifteen students and graduates. In part two, the tests were administered to one hypothetical subject, but the results were abnormal state. The names of the subjects were listed in part two to determine abnormal state. The names of the subjects in order to determine abnormal state.

APPENDIX

Aside from the tests of the abnormal state, they may have been used for other purposes when he reports his results. The abnormal state responses this reason, the group selected for the abnormal state was made as comparable to the other group. In the absence of better information, the subjects, all of whom were reported from the University of New Mexico. Some were identified as officers. A few younger family members were included. The range in age was from sixteen to twenty years. The majority falling between twenty and twenty-five.

The actual testing was carried out by two examiners who had been trained in the Binet technique. This use of two examiners served several purposes. The influence of more than one examiner could be used as a check by Captain Bradley if he uses these results to compare with his own test results. Also, more data could be obtained in the short time at the examiners' disposal. Finally, a better evaluation of the tests could be made, since one of the examiners might encounter difficulties which the other did not.

When the testing had been completed, frequency distributions of the scores made by each test group for each set of problems were made and the means and standard deviations computed. After the significance of the differences had been determined, the two sets of data were combined into one larger group comprised of the entire fifty subjects. The means, standard deviations, and standard errors of the mean were then computed for the combined data. This procedure, together with the problems met in the actual testing provided the basis for critical evaluation of the entire battery as well as for the individual test items. The major criticisms are set forth in Chapter III of this report.

In the second part of the study, the experiment was so designed that analysis of variance could be applied to

The social testing was conducted by the evaluators

who had been trained in the three conditions, with the

two examinees, one in each condition, and the

more than one examinee in each condition, and

Bradley II learned their scores in the

test results, and the results of the

short time of the experiment, the

evaluation of the test results was

examined with respect to the

not.

Then the results were compared with

criticism of the test results, and

set of workers were also compared with

actions compared. After the results were

had been determined, the two sets of

one larger from copies of the

The means, and the results, and

mean were then compared with the

score, together with the results of the

the provided the data for the

entire battery as well as the

The major criticism and the

report.

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effect of hypoglycemia independently of the influence of
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CHAPTER II

THE BRADLEY TESTS

The tests as designed by Captain Bradley together with all instructions and methods of scoring are presented here in order that they may be easily referred to in the critical evaluation which follows. The physical condition of the men he tested was such that short testing periods were most suitable. Accordingly, he planned the tests for administration in short periods on each of eight successive days.

First Day

Digit Span I: Read at the rate of one number per second. The subject is to repeat the numbers exactly in the order called. One correct response out of three trials passes each level. If ten digits are repeated back correctly, call the numbers in group 5 in reverse order and add the first digit of the next series.

- | | | | | | | |
|----|----|------------|----|------------|----|------------|
| 1. | a. | 093152 | b. | 152461 | c. | 813695 |
| 2. | a. | 5732538 | b. | 5318274 | c. | 6052801 |
| 3. | a. | 41629374 | b. | 62051926 | c. | 82791063 |
| 4. | a. | 271596731 | b. | 620194638 | c. | 854619382 |
| 5. | a. | 6723819467 | b. | 2834918629 | c. | 7521143829 |

The score is the number of digits in the highest correct response.

Comprehension I: The subject reads the following paragraph silently for one minute. Then he writes in his own words

CHAPTER II

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First Day

Digit Span I: Read at the rate of one number per second. The subject is to repeat the numbers exactly in the order called. One correct response out of three trials begins each level. If ten digits are repeated back correctly, call the numbers in group B in reverse order and add the first digit of the next series.

1.	a.	093152	b.	152451	c.	512225
2.	a.	573223	b.	321274	c.	2022801
3.	a.	4122374	b.	2202122	c.	2274102
4.	a.	27122731	b.	22012222	c.	22421222
5.	a.	27221242	b.	222421222	c.	22212222

The score is the number of digits in the highest correct response.

Comprehension I: The subject reads the following paragraph silently for one minute. Then he writes in his own words

all the ideas he remembers.

"Adolescent instability is most commonly seen between the ages of 17 and 24. It is more prevalent in females. Its causes may be considered under the two headings of predisposing and determining.

"While I think that in some instances a predisposition to mental disturbance at this time may be acquired by the individual as a result of long-continued physical ill-health, or of injudicious upbringing and mismanagement over a number of years; nevertheless such is exceptional, and in the great majority of cases the predisposition is constitutional and inherited. The sufferer will be found to come of a stock of which many members are 'nervous,' 'highly strung,' 'hysterical,' or have suffered from epilepsy, insanity, or some psychosis. He has inherited a mental constitution inherently less stable than that of the normal person."

In scoring, one point is given for each idea remembered.

The number of points possible is 36.

Card Extent I: Use a deck of 52 cards. Lay out the cards at the rate of one per second, stacking them face up, until six cards are out. Then turn the stack. The subject is to call the cards but not the suits. If he passes by calling one group correctly out of three trials, try seven cards, then eight, etc. If he fails on six, try five, then four, etc. The score is the highest number of cards called.

Word Knowledge: The subject is to write three sentences using each of the following pairs of words. The words must be used so as to indicate their meaning.

1. Cacaphonous - Irascibility
2. Umbrageous - Adumbration
3. Prolix - Succint

all the ideas he remembers.

"Adolescent instability is most commonly seen between the ages of 14 and 24. It is more prevalent in females. Its causes may be considered under the two headings of predisposing and determining."

"While I think that in some instances a predisposition to mental disturbance at this time may be acquired by the individual as a result of long-continued physical illness, or of injudicious upbringing and mismanagement over a number of years; nevertheless such is exceptional, and in the great majority of cases the predisposition is constitutional and inherited. The sufferer will be found to come of a stock of which many members are 'nervous,' 'highly strung,' 'hysterical,' or have suffered from epilepsy, insanity, or some psychosis. He has inherited a mental constitution inherently less stable than that of the normal person."

In scoring, one point is given for each idea remembered.

The number of points possible is 50.

Card Extent I: Use a deck of 52 cards. Lay out the cards at the rate of one per second, spacing them face up, until six cards are out. Then turn the deck. The subject is to call the cards but not the suits. If he passes by calling one group correctly out of three trials, try seven cards, then eight, etc. If he fails on six, try five, then four, etc. The score is the highest number of cards called.

Word Knowledge: The subject is to write three sentences using each of the following pairs of words. The words must be used so as to indicate their meaning.

1. Cacophonous - Irresistibility
2. Unpleasant - Admiration
3. Prolix - Succinct

One point is given for each word used correctly.

Second Day

Memory Span Words: The words are called at the rate of one per second. The subject is to repeat them back in correct order. One accurate repetition out of three trials passes each level.

1. (a) love hat cheese walk cane raid
(b) ace wan soon face right cat
(c) wand seed rain bat rest fall
2. (a) rice door face sin mat dog race
(b) waltz shelf door spade wall run cry
(c) bet sea lace reed meat call dry
3. (a) seat pall lay hen rest fool asp file
(b) drool aisle pig wren bless flee volt blast
(c) sky march ream low keen sing blow mean
4. (a) go spleen cave dish mist due guest rile boil
(b) sit ball can mask scream lain sense win vice
(c) balk rasp lock won bolt fin but rope deep

The score is the highest number of words called correctly.

Digit Span II: The instructions and scoring are the same as in Digit Span I.

- | | | |
|-------------------|----------------|----------------|
| 1. (a) 520739 | (b) 273849 | (c) 916385 |
| 2. (a) 2583917 | (b) 8527493 | (c) 4703815 |
| 3. (a) 72583964 | (b) 31692748 | (c) 61829374 |
| 4. (a) 274906381 | (b) 192748562 | (c) 529473085 |
| 5. (a) 3827491506 | (b) 3819147290 | (c) 9475293507 |

Orientation I: The examiner says, "From the place of beginning I went Where am I from the place of beginning?"

The rate of reading is one word per second.

One point is given for each word read correctly.

Second Day

Memory Span Words: The words are called at the rate of one per second. The subject is to repeat them back in correct order. One accurate repetition out of three trials passes each level.

- 1. (a) love hat cheese walk came rain
(b) see van soon face right cat
(c) wand need rain hat rest fall
- 2. (a) rice door face air hat dog race
(b) walk shelf door space will run cry
(c) bet see face need meat call cry
- 3. (a) seat ball fry hen rest fool and tie
(b) brool aiale gly was glass five volt plant
(c) sky march team low keen air blow mean
- 4. (a) co sison cave dish what the great life ball
(b) sit ball can mark screen rain some win vice
(c) baik reap look war bolt tin but tone deep

The score is the highest number of words called correctly.

Digit Span II: The instructions and scoring are the same

as in Digit Span I.

- 1. (a) 520739 (b) 273849 (c) 61385
- 2. (a) 258397 (b) 327498 (c) 470312
- 3. (a) 7258394 (b) 31902748 (c) 6192374
- 4. (a) 27490331 (b) 19874582 (c) 52947599
- 5. (a) 382749108 (b) 391914280 (c) 912325507

Orientation I: The examiner says, "From the place of beginning I went then and I from the place of beginning"

The rate of reading is one word per second.

1. Two miles W - 3S - 4E - 1N - 1W - 2N - 4S - 2E - 3N and finally 3W.
2. One block E - 2N - 3W - 1S - 4E - 1N - 1W - 2N - 2W - 3S and finally 3E.
3. Three miles (or blocks) W - 5N - 1W - 1N - 3E - 6S - 2N - 1W - 1S - 4E - 3N and finally 1/2 S.

In scoring, Captain Bradley allowed five points for each correct answer. This was modified in the study reported, only one point being allowed for each answered correctly. The subject was shown the problems which he missed.

Rote II (Nonsense): The subject reads the nonsense syllables for one minute, reading downward. Then he writes all of them he can remember in order from the beginning. Three trials of one minute each are given.

ZAK	PIF	SIK	NAF	LOR	SLE
LOC	OTI	FRO	BOK	OST	LAK
FIZ	CLO	DRA	KOZ	RUK	MAF
APO	KAM	ZEF	ZIM	DAK	NEB
ENO	ZUB	OFE	OKO	SMO	TUK
ZOC	LIB	CIT	ARU	LUF	FYZ

One point is given for each correct syllable in the proper order. Only the best of the three trials are recorded.

Third Day

Card Extent II: Scoring and instructions are the same as for Card Extent I given on the first day.

Orientation II: The instructions and scoring are the same as for Orientation I given on the second day. The distances and directions follow.

- 1. Two miles W - 32 - 42 - 12 - 12 - 42 - 42 - 32 and finally 3W.
- 2. One block E - 3W - 3W - 12 - 42 - 12 - 3W - 32 and finally 3E.
- 3. Three miles (or blocks) W - 3W - 12 - 12 - 32 - 32 - 1W - 12 - 42 - 3W and finally 1/2 E.

In scoring, Captain Bradley allowed five points for each correct answer. This was modified in the study reported, only one point being allowed for each answer correctly. The subject was shown the problems which he missed.

Note II (Nonsense): The subject read the nonsense syllables for one minute, reading downward. Then he writes all of them he can remember in order from the beginning. Three trials of one minute each are given.

200	112	112	112	112	112	112	112
100	112	112	112	112	112	112	112
100	112	112	112	112	112	112	112
100	112	112	112	112	112	112	112
100	112	112	112	112	112	112	112
100	112	112	112	112	112	112	112
100	112	112	112	112	112	112	112
100	112	112	112	112	112	112	112
100	112	112	112	112	112	112	112
100	112	112	112	112	112	112	112

One point is given for each correct syllable in the proper order. Only the best of the three trials are recorded.

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Orientation II: The instructions and scoring are the same as for Orientation I given on the second day. The distances

and directions follow.

1. Four miles W - 2N - 1E - 6S - 5E - 1N - 1E and finally 3S.
2. Three blocks N - 4E - 1/2 S - 3W - 2N - 1E - 2 1/2 S and finally 1W.
3. Three miles (or blocks) E - 4S - 1W - 5N - 2E - 2S - 3W and finally 4 1/2 N.

Prose Verbatim I: The subject is to repeat the sentences exactly as read by the examiner.

1. The old weather-beaten house loomed before him, gloomy, sinister, and foreboding. (11 points)
2. The fallacy of a democracy lies in its inherent incapability of decisive action in time of crisis. (17 points)
3. The presence of gill slits in the embryonic state is pointed out as an irrefutable corroboration of the statement that ontogeny recapitulates phylogeny. (23 points)

For each sentence repeated correctly the number of points indicated in parentheses are given.

Fourth Day

Digit Span III: Instructions and scoring are the same as for Digit Span I given on the first day.

- | | | |
|-------------------|----------------|----------------|
| 1. (a) 416732 | (b) 730152 | (c) 851492 |
| 2. (a) 9614827 | (b) 4679285 | (c) 5383714 |
| 3. (a) 49367208 | (b) 84720391 | (c) 35829103 |
| 4. (a) 520741906 | (b) 627483591 | (c) 184691527 |
| 5. (a) 8479367253 | (b) 4839623970 | (c) 0913728057 |

Prose Retention I: The examiner reads the following paragraph aloud. The subject is to recall as many of the ideas expressed as he can.

Philadelphia, July 18. At the fifty-sixth International Congress of Science assembled at Philadelphia,

- 1. Four miles W - SW - W - NW - N - NE - E - SE - S - SW - W - NW - N - NE - E - SE - S - SW and finally 3S.
- 2. Three blocks W - AE - 1/2 S - SW - W - NW - N - NE - E - SE - S - SW and finally 1W.
- 3. Three miles (or blocks) E - SE - S - SW - W - NW - N - NE - E - SE - S - SW and finally 4 1/2 W.

Prose Verbatim I: The subject is to repeat the sentences

exactly as read by the examiner.

- 1. The old weather-beaten house looked before me, (11 points)
 sinister, and forbidding. (11 points)
- 2. The fallacy of a democracy lies in its inherent incoher- (11 points)
 dence of decisive action in time of crisis. (11 points)
- 3. The presence of all sides in the American struggle (11 points)
 pointed out as an irreconcilable contradiction of the state- (11 points)
 ment that ordinary reactionaries espouse. (11 points)

For each sentence repeated correctly the number of points

indicated in parentheses are given.

Fourth Day

Dict Span III: Instructions and scoring are the same as

for Dict Span I given on the first day.

- | | | | | | | |
|----|-----|--------|-----|--------|-----|--------|
| 1. | (a) | 418732 | (c) | 730152 | (c) | 321422 |
| 2. | (a) | 921422 | (d) | 420222 | (c) | 320222 |
| 3. | (a) | 422222 | (d) | 212222 | (c) | 322222 |
| 4. | (a) | 220422 | (d) | 221222 | (c) | 122222 |
| 5. | (a) | 242222 | (d) | 222222 | (c) | 021222 |

Prose Retention I: The examiner reads the following para-

graph aloud. The subject is to recall as many of the ideas expressed as he can.

Philadelphia, July 12. At the fifty-sixth Inter-
 national Congress of Science assembled at Philadelphia,

Pennsylvania, Dr. R. G. Peterson today presented a paper on the effects of acetylcholine on the brain. Peterson is a noted neurologist, and his experiments with drugs have attracted international attention.

One point is given for each idea retained, with the highest possible score fifteen points.

Orientation III: Instructions and scoring are the same as for Orientation I shown in the tests for the second day.

1. Two miles S - 4W - 4N - 3E - 1S - 6W - 2S - 3E - 1N and finally 2W.
2. One block E - 1S - 2W - 2N - 1E - 1N - 1E - 1S - 2W - 1N and finally 1E.
3. One mile (or block) S - 1W - 1E - 1N - 1N - 2E - 2S - 3W and finally 1E.

Fifth Day

Retention-Comprehension: The examiner reads fourteen series of instructions one at a time. After each series is read, the subject is given one minute to complete the instructions given in that series. All letters and numbers are to be made relatively small but easily discernible. All letters and numbers must be legible.

A. Draw a line approximately two inches in length in a horizontal plane located centrally on the page. Label this line with a capital letter A at its midpoint, and at a point just beneath the line. (6 points)

B. At the terminal point of the line on the right hand side and at a point immediately beneath the terminal point place the Arabic numeral 2. At a corresponding point on the left hand side place the Arabic numeral 1. (7 points)

C. At a distance of one third the length of line A and in a horizontal plane beneath and parallel to line A,

Pennsylvania, Dr. R. S. Peterson today presented a paper on the effects of acetylcholine on the brain. Peterson is a noted neurologist, and his experiments with drugs have attracted international attention.

One point is given for each idea retained, with the highest possible score fifteen points.

Orientation III: Instructions and scoring are the same as

- for Orientation I shown in the tests for the second day.
1. Two miles S - 40 - 4N - 3E - 1S - 2W - 3S - 4W - 1N
 - and finally SW.
 2. One block E - 1S - 2W - 3N - 1E - 1S - 1E - 2W
 - 1N and finally E.
 3. One mile (or block) S - 1W - 1E - 1W - 1E - 1W - 1S - 1S
 - 3W and finally E.

Fifth Day

Retention-Comprehension: The examiner reads fourteen series

of instructions one at a time. After each series is read, the subject is given one minute to complete the instructions given in that series. All letters and numbers are to be made relatively small but easily discernible. All letters and numbers must be legible.

A. Draw a line approximately two inches in length in a horizontal plane located centrally on the page. Label this line with a capital letter A at its midpoint, and at a point just beneath the line.

B. At the terminal point of the line on the right hand side and at a point immediately beneath the terminal point place the Arabic numeral 2. At a corresponding point on the left hand side place the Arabic numeral 1.

(4 points)

C. At a distance of one third the length of line A and in a horizontal plane beneath and parallel to line A,

draw a line of identical length to line A and label this line with the capital letter B above its center. Label its terminal points with the Arabic numerals 3 and 4 placed just above said points from left to right respectively. (10 points)

D. At the center of line A erect a perpendicular of equal length to A and label it with the capital letter C at a point central to it and to its right. (6 points)

E. At a corresponding point on line B drop a perpendicular of equal length to lines A, B, and C, and label this line with the capital letter D at a point central to it and also to the right of the line. (6 points)

F. At the terminal point of the line erected perpendicular to line A, that is line C, at a point immediately above it and in the same vertical plane, place the Arabic numeral 6. At a corresponding position below the terminal point of line D, place the Arabic numeral 5. (7 points)

G. Draw a line from point 6 to point 2, and at a point central and to the right of it label with the capital letter F. (4 points)

H. Draw a similar line from point 6 to point 1. Label this line with the capital letter E at a point central to it and to its left. Label the included angle at the junction of the sides A and E with the small letter a'. With this as a starting point, label the other two angles of the right triangle AEC b' and c' respectively, proceeding in a clockwise direction. Label the corresponding angles in the right triangle AFC a'', b'', and c'' respectively in a counterclockwise direction.¹ (12 points)

I. Now draw a line from point 5 to point 4, and another from point 5 to point 3. Label the former at the midpoint and to its right with the capital letter H. Label the latter at a similar point and to the left with the capital letter G. (9 points)

J. Label the included angle at the junction of line G with line B with the small letter d'. Proceeding clockwise from d', label the remaining two angles of the inverted right triangle BGD e' and f' respectively. Label

¹In reading, the directions a' and a'' are called a prime and a second, not a double prime.

Draw a line of identical length to line A and label this line with the capital letter B above its center. Label its terminal points with the Arabic numerals 2 and 3 placed just above said points from left to right respectively.

(10 points)
D. At the center of line A erect a perpendicular of equal length to A and label it with the capital letter G at a point central to it and to its right.

(8 points)
E. At a corresponding point on line B draw a perpendicular of equal length to line A, B, and G, and label this line with the capital letter H at a point central to it and also to the right of the line.

(8 points)
F. At the terminal point of the line erected perpendicular to line A, draw a line I, at a point immediately above it and in the same vertical plane, place the Arabic numeral 4. At a corresponding position along the terminal point of line B, place the Arabic numeral 5.

(7 points)
G. Draw a line from point 5 to point 4, and at a point central and to the right of it label with the capital letter J.

(4 points)
H. Draw a similar line from point 6 to point 1. Label this line with the capital letter K at a point central to it and to its left. Label the included angle at the junction of the sides A and K with the small letter a'. With this as a starting point, label the other two angles of the right triangle A'K' and a' respectively, proceeding in a clockwise direction. Label the corresponding angles in the right triangles A'B' and a' respectively in a counterclockwise direction.

(12 points)
I. Now draw a line from point 3 to point 4, and another from point 5 to point 6. Label the former at the midpoint and to its right with the capital letter L. Label the latter at a similar point and to the left with the capital letter M.

(9 points)
J. Label the included angle at the junction of line G with line B with the small letter b'. Proceeding clockwise from b', label the remaining two angles of the inverted right triangle GBD a' and c' respectively. Label

¹In reading, the directions a' and b' are called a prime and a second, not a double prime.

the corresponding angles of the inverted triangle BDH d", e", and f" respectively, proceeding in a counterclockwise direction. (8 points)

K. Now draw a line at right angles to the line F with the point of origin at point 2 and one half the length of line A, so that it forms an angle of 45 degrees to the vertical plane of line C. At the midpoint of this line and to its right, place the capital letter I. (7 points)

L. Draw a similar line with the point of origin at point 4 so that this line will also form a right angle to line H. Now draw identical lines to those just described with their origins at points 3 and 1 so that the entire structure will be symmetrical to the eye. (4 points)

M. Now proceeding in a counterclockwise manner from line I, label the newly constructed lines at points lateral to their included angle and central to the lines with the capital letters J, K, and L respectively. (5 points)

N. Finally, draw a line connecting point 1 with point 4. Draw a similar line connecting point 2 with point 3. In the right hand exterior angle formed by the intersection of these lines, place the Arabic numeral 7. (4 points)

In scoring the points are distributed as indicated by the underscoring. Points received for each series correctly done are shown in the parentheses. A total of 95 points is the highest possible score. The scoring key is shown by Figure 1, page 50.

Digit Substitute: Instructions and scoring for this test are the same as for Digit Span I given on the first day.

- | | | |
|------------------|---------------|---------------|
| 1. (a) AMCIYO | (b) XFNRHZ | (c) EKCMFT |
| 2. (a) CPSHMQA | (b) LTYGIKU | (c) BMCVODX |
| 3. (a) RDMYVXTI | (b) CORGFAXS | (c) YMLDFERO |
| 4. (a) XZSPNDRHG | (b) FSPZOKNRH | (c) APDXMCRFG |

the corresponding angles of the inverted triangles $\triangle ABC$ and $\triangle A'B'C'$, respectively, proceeding in a counter-clockwise direction. (8 points)

K. Now draw a line at right angles to line BC with the point of contact at point D and one half the length of line BC , so that it forms an angle of 45° degrees to the vertical plane of line BC . At the midpoint of this line and to its right, place the capital letter F . (7 points)

L. Draw a similar line with the point of contact at point E so that this line will also form a right angle to line BC . Now draw identical lines to those just described with their origins at points B and C so that the entire structure will be symmetrical to the eye. (4 points)

M. Now proceeding in a counter-clockwise manner from line F , label the newly constructed lines as points labeled to their included angles and central to the lines with the capital letters $G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z$, respectively. (5 points)

N. Finally, draw a line connecting point F with point Z . Draw a similar line connecting point G with point Y . In the right hand exterior angle formed by the intersection of these lines, place the Arabic numeral 1 . (4 points)

In scoring the points are distributed as indicated by the underscoring. Points received for each series correctly done are shown in the parentheses. A total of 25 points is the highest possible score. The scoring key is shown by Figure 1, page 20.

Digit Substitution: Instructions and Scoring for this test
are the same as for Digit Span 1 given on the first day.

1.	(a)	AMCTYC	(b)	K WRRNE	(c)	EXCHWT
2.	(a)	CPSEMG	(b)	LEYSIR	(c)	EVQVON
3.	(a)	RDMVYXTI	(b)	CONWALS	(c)	WIKRERO
4.	(a)	XSPDRNG	(b)	SPCOWNE	(c)	RPKXDRNG

Note II (Homophone): This is a repetition of the test given on the second day.

Sixth Day

Completion: The instructions to the subject are: Read the sentence carefully and fill in the blank spaces with the number of words indicated in such a manner that the sentence will be sensible and correct. Definite articles do not count. Where a rhyme is called for the rhyming word must have the same number of syllables as the stimulus word: e.g., as a rhyme for irritate, irritate would be satisfactory, whereas mate would not.

1. Esperanto was initially designated (a) (1) and (b) (2)
2. HCl is the chemical formula for (1) and this is known commercially as (2)
3. 2 + 4 + 8 + 16 is an example of (a) (1) and (b) (2)
4. Sociology deals with the (1) and psychology deals with the (2)
5. The science which deals with the phenomena of weather is known as (1) and is a branch of (2)
6. Paleontology is one of the subdivisions of the science of (1)
7. Etymology entails the study of (1) whereas entomology is the study of (2)
8. Synonymity is synonymous with (1)
9. Three words which rhyme with (1) are (2) and (3)
10. Antic rhymes with (1) and (2) and (3)
11. Enervated is the same thing as (1)
12. The opposite of exogenous is (1) which also rhymes with it.

In scoring, one point is allowed for each blank, making a total of 25 points for the test. There is a time limit of ten minutes on this test.

Digit Span IV: Instructions and scoring for this test are the same as for Digit Span I given on the first day.

- | | | | | | | |
|----|-----|------------|-----|------------|-----|------------|
| 1. | (a) | 813572 | (b) | 628417 | (c) | 942863 |
| 2. | (a) | 7914280 | (b) | 2718630 | (c) | 5183964 |
| 3. | (a) | 74038192 | (b) | 60359424 | (c) | 84039748 |
| 4. | (a) | 731962018 | (b) | 941382752 | (c) | 018375269 |
| 5. | (a) | 9274625738 | (b) | 9016483975 | (c) | 4853072935 |

Comprehension II: Instructions and scoring are the same as for Comprehension I given on the first day, except that a total of points is only 32 for this test.

"The term 'temperament' applies to still more enduring mental states (than those encountered in emotional states.) The historical and classic division of temperaments into sanguine, melancholic, choleric, and phlegmatic has little basis in fact; but, while no sharp cleavages exist between one temperament and another and while every individual is a composite of all four, the classification is useful in characterizing certain differences that are known to exist in some amount. The choleric type is easily provoked and characterized by intensity of feeling, while the sanguine, although easily provoked, is relatively feeble in emotional reaction. The melancholic type is slow in response but characterized by intense sadness or gloominess when once evoked. Phlegmatic types are slow to act and disinterested or cold to ordinary situations in life."

Seventh Day

Synthetic Language: The subject is given five minutes to study the following words:

In scoring, one point is allowed for each blank, making a total of 25 points for the test. There is a time limit of ten minutes on this test.

Day Span IV: Instructions and scoring for this test are

the same as for Day Span I given on the first day.

- | | | | | | | |
|----|-----|------------|-----|-----------|-----|-----------|
| 1. | (a) | 813572 | (d) | 888414 | (c) | 942222 |
| 2. | (a) | 7914280 | (d) | 271820 | (c) | 218202 |
| 3. | (a) | 74038192 | (d) | 6038944 | (c) | 64032748 |
| 4. | (a) | 73192018 | (d) | 94132732 | (c) | 02827022 |
| 5. | (a) | 9274222720 | (d) | 201942227 | (c) | 422272272 |

Comprehension II: Instructions and scoring are the same as

for Comprehension I given on the first day, except that a

total of points is only 22 for this test.

"The term 'temperament' applies to still more orderly mental states (than those encountered in emotional states). The historical and classic division of temperament into sanguine, melancholic, choleric, and phlegmatic has little basis in fact; but, while no sharp cleavages exist between one temperament and another and while every individual is a composite of all four, the classification is useful in describing certain differences that are known to exist in some amount. The choleric type is easily provoked and characterized by intensity of feeling, while the sanguine, although easily provoked, is relatively feeble in emotional reaction. The melancholic type is slow in response but characterized by intense sadness or gloominess when once evoked. Phlegmatic types are slow to act and distinguished or cold to ordinary situations in life."

Seventh Day

Synthetic Language: The subject is given five minutes for

study the following words:

- | | | |
|----------------|------------------|--------------------|
| 1. Boy - Ako | 5. Pretty - Zema | 9. Bright - Moku |
| 2. Girl - Amu | 6. The - Eta | 10. Talking - Hare |
| 3. Is - Ekos | 7. Island - Zita | 11. And - Atu |
| 4. Were - Erak | 8. Large - Kamo | |

At the end of the five minute study period the subject is instructed to write out translations of the following sentences.

1. Eta ako atu amu erak hare.
2. Eta amu ekos moku atu zema.
3. Eta zita ekos kamo.
4. Eta kamo zita ekos zema.
5. Eta ako ekos kamo.

The score is one point for each word correctly translated.

Perception: The form used for this test is shown on the following page. The instructions given to the subject are: "Find words in the rows (horizontal) and then in the vertical columns. Proper nouns, foreign terms, and abbreviations are not counted. All combinations of a word must be exhausted in order to score one hundred per cent; e.g., candid, can, did, an, and." Three minutes are allowed for the test, and all words found in that period are given one point in the scoring. A total of 55 points is possible. In the form used, the letters and numbers are six millimeters high and are placed in the center of squares having dimensions of one centimeter by one centimeter.

Prose Retention II: The instructions and scoring for this test are the same as for Prose Retention I given on the fourth day.

- 1. Boy - Aho
- 2. Girl - Aho
- 3. Is - Ekos
- 4. Were - Erak
- 5. Pretty - Ewas
- 6. The - Epa
- 7. Island - Epa
- 8. Large - Ewas
- 9. Light - Ewas
- 10. Light - Ewas
- 11. And - Epa

At the end of the five minute study period the subject is instructed to write out translations of the following sen-

tences.

- 1. Epa eka stu era here.
- 2. Epa eka moa ain eka.
- 3. Epa eka kamo.
- 4. Epa kamo eka eka.
- 5. Epa eka kamo.

The score is one point for each word correctly translated.

Perception: The form used for this test is shown on the following page. The instructions given to the subject are: "Find words in the rows horizontally, and then in the vertical columns. Proper nouns, foreign names, and abbreviations are not counted. All combinations of a word must be extracted in order to score one hundred per cent; e.g., candle, can, odd, and, and." Three minutes are allowed for the test, and all words found in that period are given one point in the scoring.

A total of 55 points is possible. In the form used, the letters and numbers are six millimeters high and are placed in the center of spaces having dimensions of one centimeter by one centimeter.

Phrase Retention II: The instructions and scoring for this

test are the same as for phrase retention I given on the

fourth day.

ILLUSTRATION 1
FORM USED FOR THE PERCEPTION TEST

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	A	G	M	C	E	T	R	O	W	X	B	Y	N	C	T
2	V	G	X	K	L	E	N	D	X	Z	I	T	I	F	G
3	R	K	S	T	K	I	N	L	G	O	V	Z	D	O	F
4	C	O	V	X	L	I	N	Z	O	R	K	Y	E	S	T
5	W	A	N	L	K	B	E	T	K	A	C	H	E	B	Z
6	Z	O	X	O	L	D	V	E	N	T	K	R	A	N	D
7	Y	S	P	Q	T	M	D	R	Y	F	G	F	O	G	X
8	M	O	A	T	X	Z	R	K	C	L	A	N	G	P	F
9	C	A	N	A	S	K	Z	A	D	Z	M	N	D	P	Q
10	G	V	A	P	E	N	O	T	X	Z	D	V	Q	R	S

JO	G	A	V	B	E	M	Q	L	X	S	D	A	6	Ь	2
8	C	V	Y	В	В	А	Х	V	D	X	Е	И	D	Ь	6
9	E	C	V	L	X	У	Е	К	C	D	V	М	0	Ь	3
A	Z	Q	Б	С	Б	И	L	Ь	L	Е	0	Е	0	0	Х
9	X	0	Х	С	Г	D	A	Е	Р	L	L	Р	V	И	D
2	A	V	В	Г	Е	Е	Е	L	К	V	С	И	Х	В	3
4	C	С	A	Х	Г	И	И	С	0	И	К	Ж	Е	2	5
2	X	К	В	М	К	И	И	Г	С	С	A	С	D	С	8
8	A	C	Y	K	Г	У	И	D	X	С	I	L	I	Ь	6
J	V	0	И	С	Е	L	Ь	0	A	X	В	A	И	С	L
	J	S	2	4	2	С	A	8	8	JO	JJ	IS	J3	J4	J2

КОДЫ ИСПОЛЗОВАНЫ ДЛЯ РАССЕЛЕНИЯ ЛЕГКИ

ИТТЕРИКАЦИЯ И

Chicago, June 16. In a report upon recent experimentation with variable angles of incidence in airplane wings, Carl V. Johnson, noted aeronautical engineer predicts that planes of the future will have hydraulically controlled wings, thus enhancing climbing performance considerably.

Prose Verbatim II: This test is administered and scored in the same manner as Prose Verbatim I given on the third day.

1. The forehead of the Indian was bedizined with herbage and paint. (11 points)
2. The aptitude for achievement in the human organism is inversely proportional to the deficiency of neural toxicity. (17 points)
3. The so-called corrugator phenomenon, i.e., an intermittent and spasmodic activation of the superciliary corrugator muscles, is a commonly manifest symptom in schizophrenia. (23 points)

Eighth Day

Association Recall-Antonyms: The subject is to list one antonym for each of the following words. The antonym must be identical in function as a part of speech to the stimulus word; e.g., if the stimulus word is a noun, the response must be with a noun; if an adjective, the response must be with an adjective. No hyphenated compoundings (word kennings) may be used; e.g., with the stimulus word "incorrigible," the response "tractable" would be satisfactory. "Easy-going," "easy-to-handle" would be unsatisfactory. The response must be an acceptably approximate antonym; e.g., with the stimulus word cited above "manageable," "submissive" would be satisfactory, whereas "suggestible" would not, since a person might be suggestible and still be incorrigible if susceptible

Chicago, June 16. In a report upon recent experi-
 mentation with variable angles of incidence in airplane
 wings, Carl V. Johnson, noted aeronomical engineer, making
 that planes of the future will have hydraulically controlled
 wings, thus enhancing climbing performance considerably.

Prose Verbatim II: This test is administered and scored in
 the same manner as Prose Verbatim I given on the third day.

1. The forehead of the Indian was bedizened with feathers
 and paint. (11 points)
2. The attitude for achievement in the human organism is
 inversely proportional to the delicacy of mental
 toxicity. (14 points)
3. The so-called corruptor phenomenon, i.e., an inter-
 mittent and sporadic activation of the excretory
 corruptor muscles, is a commonly earliest symptom in
 schizophrasia. (23 points)

Sixth Day

Association Recall-Anonymus: The subject is to list one
 synonym for each of the following words. The synonyms must
 be identical in function as a part of speech to the stimulus
 word; e.g., if the stimulus word is a noun, the response must
 be with a noun; if an adjective, the response must be with an
 adjective. No hyphenated compounds (word remainings) may be
 used; e.g., with the stimulus word "incorrigible," the re-
 sponse "tractable" would be satisfactory. "Easy-going,"
 "easy-to-handle" would be unsatisfactory. The response must
 be an acceptably approximate synonym; e.g., with the stimu-
 lus word cited above "managerial," "spontaneous" would be
 satisfactory, whereas "suggestible" would not, since a person
 might be suggestible and still be incorrigible or unacceptible

to suggestion from undesirable influence. The response should be made with an opposite as far removed as possible from the meaning of the stimulus word.

- | | | |
|----------------|-----------------|------------------|
| 1. Acrimonius | 6. Catholicity | 11. Recalcitrant |
| 2. Lethargic | 7. Irrefutable | 12. Carnivorous |
| 3. Homunculus | 8. Inhospitable | 13. Impeccable |
| 4. Peripatetic | 9. Belligerent | 14. Transient |
| 5. Recondite | 10. Antipathy | 15. Meticulous |

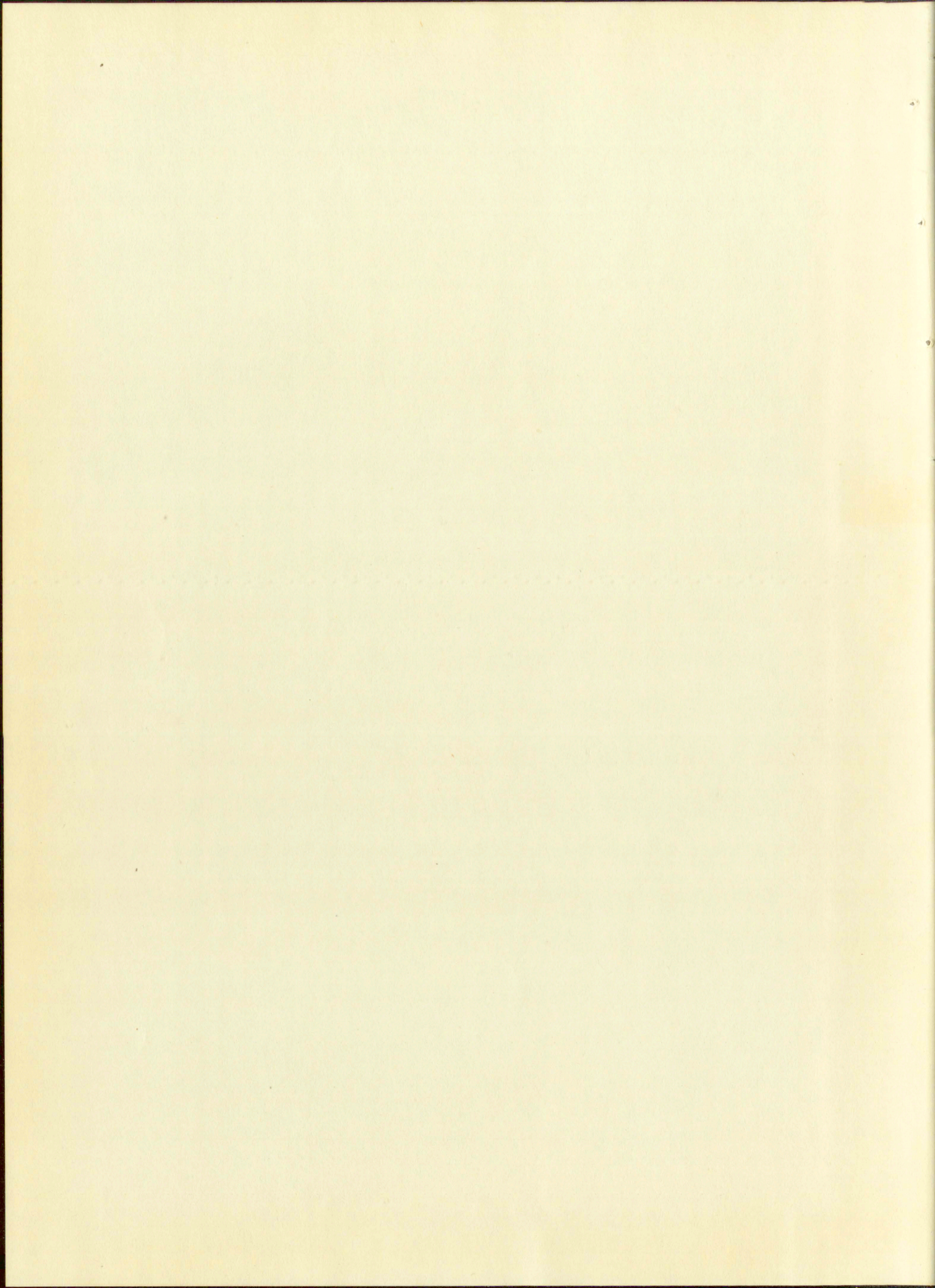
In scoring this test one point is given for each antonym correctly supplied. Ten minutes is the maximum time allowed.

Reasoning: The subject is permitted five minutes in which to solve the first and third problems, but only three minutes for the second one. Pencil and paper are not to be used. The third problem is read aloud by the examiner, and the subject is not permitted to see the problem. He is given the other two problems to see while solving them.

1. A plant grew to 8 inches in height during the first six months after planting. At one year, it had reached a height of 12 inches. At 1 1/2 years, it had attained a height of 18 inches. At the end of two years it was 27 inches tall. How tall was it at the end of 2 1/2 years?¹

2. I had a car capable of a top speed of 75 miles per hour. I determined to drive 180 miles in three hours. At the end of the first hour, after covering 60 miles, I stopped twenty minutes for lunch. I decided to make up the lost time and cover the remaining distance of 120 miles at the end of the three hours I initially allotted to the trip if the top speed of my car would permit. At what exact speed must I drive to cover the remaining distance in the available time?

¹This problem is one which Captain Bradley remembered from Form L of the Revised Stanford-Binet Scale.



3. I started with \$10.00. I made a purchase worth \$5.37. I then made a purchase worth \$1.60. I then spent an additional 49 cents. Following this, I made two additional purchases of 68 cents and 32 cents respectively. At this time I received \$5.48 in payment on a debt. How much do I now have?

Credit of one point is given for each correct answer.

Practical considerations demanded that Captain Bradley's procedure of using short testing period for eight consecutive days be modified. The class schedules of both the subjects and the examiners proved too great an obstacle to this plan. Careful examination of the tests, however, convinced those concerned with making this study of the inadvisability of giving the tests in one sitting, since the same set of nonsense syllables were used for both of the Rote II Nonsense tests. Also, the scores made on the Orientation tests might be influenced by giving these all in one period. A preliminary try-out showed that a minimum of two and one half hours would be required for the entire test. The best solution to all the problems involved was to use three fifty-minute testing periods on alternate days in lieu of the shorter periods for eight consecutive days. In general, the three-day plan was followed, though an occasional subject required additional time, necessitating a fourth period. In other respects the tests were given according to Captain Bradley's instructions.

the data. In the first place, the effect of atmospheric conditions on the difference in the readings of the gauge and the influence of the

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Fifty men selected from the undergraduate students, graduate students, and faculty members of the University of New Mexico were tested by two examiners. The ages of the subjects ranged from eighteen to forty-six years, mostly between twenty and thirty. The frequency distributions of the scores are shown in Table I. Table II records the means, standard deviations, and standard errors of the means.

TABLE I

FREQUENCY DISTRIBUTIONS OF THE SCORES

Test	Examiner 1	Examiner 2
18-20	1000	1000
21-25	1000	1000
26-30	1000	1000
31-35	1000	1000
36-40	1000	1000
41-45	1000	1000
46-50	1000	1000

the data. In the first place, the effect of atmospheric conditions on the difference in the readings of the gauge and the influence of the

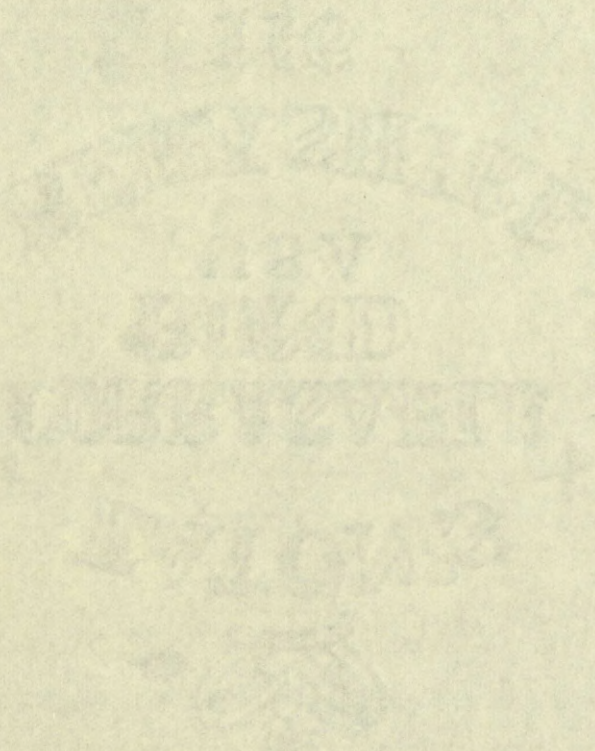


TABLE I
FREQUENCY DISTRIBUTIONS OF THE SCORES

Tests	Scores	Frequencies		
		Examiner 1 20 Subjects	Examiner 2 30 Subjects	Combined 50 Subjects
Digit Span I	7	6	3	9
	8	11	9	20
	9	3	12	15
	10	0	5	5
	11	0	1	1
Digit Span II	7	3	1	4
	8	6	10	16
	9	11	11	22
	10	0	8	8
Digit Span III	7	0	4	4
	8	6	6	12
	9	12	12	24
	10	2	7	9
	11	0	1	1
Digit Span IV	7	0	1	1
	8	5	10	15
	9	9	11	20
	10	6	8	14
Digit Substitute	6	3	0	3
	7	6	4	10
	8	8	8	16
	9	2	16	18
	10	1	2	3

Subject	Number of Subjects	Number of Examinations	Number of Correctly Answered Questions
Algebra	10	10	10
Geometry	10	10	10
Trigonometry	10	10	10
Calculus	10	10	10
Statistics	10	10	10
Probability	10	10	10
Mathematical Analysis	10	10	10
Mathematical Logic	10	10	10
Mathematical Foundations	10	10	10
Mathematical Physics	10	10	10
Mathematical Chemistry	10	10	10
Mathematical Biology	10	10	10
Mathematical Economics	10	10	10
Mathematical Psychology	10	10	10
Mathematical Sociology	10	10	10
Mathematical Anthropology	10	10	10
Mathematical Linguistics	10	10	10
Mathematical History	10	10	10
Mathematical Geography	10	10	10
Mathematical Meteorology	10	10	10
Mathematical Oceanography	10	10	10
Mathematical Astronomy	10	10	10
Mathematical Cosmology	10	10	10
Mathematical Philosophy	10	10	10
Mathematical Ethics	10	10	10
Mathematical Law	10	10	10
Mathematical Medicine	10	10	10
Mathematical Agriculture	10	10	10
Mathematical Industry	10	10	10
Mathematical Commerce	10	10	10
Mathematical Education	10	10	10
Mathematical Art	10	10	10
Mathematical Music	10	10	10
Mathematical Literature	10	10	10
Mathematical Religion	10	10	10
Mathematical Science	10	10	10
Mathematical Technology	10	10	10
Mathematical Engineering	10	10	10
Mathematical Architecture	10	10	10
Mathematical Design	10	10	10
Mathematical Communication	10	10	10
Mathematical Management	10	10	10
Mathematical Leadership	10	10	10
Mathematical Innovation	10	10	10
Mathematical Creativity	10	10	10
Mathematical Problem Solving	10	10	10
Mathematical Critical Thinking	10	10	10
Mathematical Decision Making	10	10	10
Mathematical Strategic Planning	10	10	10
Mathematical Risk Management	10	10	10
Mathematical Quality Control	10	10	10
Mathematical Process Improvement	10	10	10
Mathematical Customer Satisfaction	10	10	10
Mathematical Employee Engagement	10	10	10
Mathematical Organizational Culture	10	10	10
Mathematical Change Management	10	10	10
Mathematical Project Management	10	10	10
Mathematical Time Management	10	10	10
Mathematical Stress Management	10	10	10
Mathematical Work-Life Balance	10	10	10
Mathematical Career Development	10	10	10
Mathematical Personal Growth	10	10	10
Mathematical Self-Improvement	10	10	10
Mathematical Mindfulness	10	10	10
Mathematical Meditation	10	10	10
Mathematical Yoga	10	10	10
Mathematical Tai Chi	10	10	10
Mathematical Martial Arts	10	10	10
Mathematical Sports	10	10	10
Mathematical Recreation	10	10	10
Mathematical Entertainment	10	10	10
Mathematical Leisure	10	10	10
Mathematical Hobbies	10	10	10
Mathematical Interests	10	10	10
Mathematical Passions	10	10	10
Mathematical Dreams	10	10	10
Mathematical Aspirations	10	10	10
Mathematical Goals	10	10	10
Mathematical Vision	10	10	10
Mathematical Inspiration	10	10	10
Mathematical Motivation	10	10	10
Mathematical Persistence	10	10	10
Mathematical Resilience	10	10	10
Mathematical Adaptability	10	10	10
Mathematical Flexibility	10	10	10
Mathematical Openness	10	10	10
Mathematical Curiosity	10	10	10
Mathematical Wonder	10	10	10
Mathematical Awe	10	10	10
Mathematical Gratitude	10	10	10
Mathematical Positivity	10	10	10
Mathematical Optimism	10	10	10
Mathematical Hope	10	10	10
Mathematical Faith	10	10	10
Mathematical Trust	10	10	10
Mathematical Love	10	10	10
Mathematical Compassion	10	10	10
Mathematical Kindness	10	10	10
Mathematical Generosity	10	10	10
Mathematical Humility	10	10	10
Mathematical Modesty	10	10	10
Mathematical Simplicity	10	10	10
Mathematical Minimalism	10	10	10
Mathematical Sustainability	10	10	10
Mathematical Environmentalism	10	10	10
Mathematical Social Justice	10	10	10
Mathematical Human Rights	10	10	10
Mathematical Globalization	10	10	10
Mathematical Internationalization	10	10	10
Mathematical Multiculturalism	10	10	10
Mathematical Diversity	10	10	10
Mathematical Inclusion	10	10	10
Mathematical Equity	10	10	10
Mathematical Fairness	10	10	10
Mathematical Justice	10	10	10
Mathematical Peace	10	10	10
Mathematical Non-Violence	10	10	10
Mathematical Diplomacy	10	10	10
Mathematical Negotiation	10	10	10
Mathematical Conflict Resolution	10	10	10
Mathematical Mediation	10	10	10
Mathematical Arbitration	10	10	10
Mathematical Litigation	10	10	10
Mathematical Law Enforcement	10	10	10
Mathematical Judiciary	10	10	10
Mathematical Legislature	10	10	10
Mathematical Executive Branch	10	10	10
Mathematical Judicial Branch	10	10	10
Mathematical Legislative Branch	10	10	10
Mathematical Executive Order	10	10	10
Mathematical Executive Decision	10	10	10
Mathematical Executive Action	10	10	10
Mathematical Executive Order	10	10	10
Mathematical Executive Decision	10	10	10
Mathematical Executive Action	10	10	10

ANALYSIS OF THE RESULTS OF THE EXAMINATIONS

TABLE I

TABLE I (continued)
 FREQUENCY DISTRIBUTIONS OF THE SCORES

Tests	Scores	Frequencies		
		Examiner 1 20 Subjects	Examiner 2 30 Subjects	Combined 50 Subjects
Comprehension I	0	0	1	1
	4	0	1	1
	5	1	1	2
	6	1	3	4
	7	0	2	2
	8	2	1	3
	9	1	2	3
	10	0	2	2
	11	1	1	2
	12	4	1	5
	13	2	6	8
	14	2	2	4
	15	1	2	3
	16	2	3	5
	17	0	1	1
	18	1	1	2
	19	1	0	1
	29	1	0	1
Card Span I	6	2	1	3
	7	6	1	7
	8	7	8	15
	9	2	9	11
	10	3	8	11
	11	0	3	3

TABLE I (continued)
 FREQUENCY DISTRIBUTIONS OF THE SCORES

Tests	Scores	Frequencies		
		Examiner 1 20 Subjects	Examiner 2 30 Subjects	Combined 50 Subjects
Comprehension II	1	0	1	1
	4	1	1	2
	6	0	2	2
	7	0	2	2
	8	2	3	5
	9	1	2	3
	10	3	2	5
	12	2	1	3
	13	2	2	4
	14	0	1	1
	15	1	4	5
	16	3	2	5
	17	0	3	3
	18	0	1	1
	19	1	0	1
	20	1	1	2
	21	1	1	2
23	1	0	1	
25	0	1	1	
28	1	0	1	
Prose Verbatim I	0	3	3	6
	11	13	21	34
	28	3	5	8
	34	1	1	2

Table I (continued)

FREQUENCY DISTRIBUTION OF THE SCORES

Tests	Scores	Frequencies		
		Examiner 1 20 Subjects	Examiner 2 30 Subjects	Combined 50 Subjects
Prose Verbatim II	0	5	1	6
	11	10	24	34
	28	3	5	8
	40	2	0	2
Card Span II	6	0	1	1
	7	3	2	5
	8	9	5	14
	9	5	13	18
	10	1	4	5
	11	2	4	6
	12	0	1	1
Prose Retention I	5	1	0	1
	6	2	0	2
	7	2	0	2
	8	2	1	3
	9	3	9	12
	10	3	3	6
	11	0	4	4
	12	3	3	6
	13	2	4	6
	14	2	3	5
	15	0	3	3

TABLE I (continued)
 FREQUENCY DISTRIBUTIONS OF THE SCORES

Tests	Scores	Frequencies		
		Examiner 1 20 Subjects	Examiner 2 30 Subjects	Combined 50 Subjects
Prose Retention II	6	3	0	3
	7	1	0	1
	8	3	3	6
	9	2	4	6
	10	2	7	9
	11	3	2	5
	12	3	2	5
	13	2	7	9
	14	1	4	5
	15	0	1	1
	Orientation	0	2	0
1		9	3	12
2		2	4	6
3		4	1	5
4		0	10	10
5		2	6	8
6		0	1	1
7		0	2	2
8		1	2	3
9		0	1	1
Memory Span Words	4	1	0	1
	5	2	1	3
	6	12	9	21
	7	4	13	17
	8	1	7	8

TABLE I (continued)
 FREQUENCY DISTRIBUTIONS OF THE SCORES

Tests	Scores	Frequencies		
		Examiner 1 20 Subjects	Examiner 2 30 Subjects	Combined 50 Subjects
Completion	5	0	1	1
	6	1	0	1
	10	4	4	8
	11	0	2	2
	12	2	0	2
	13	3	0	3
	14	3	3	6
	15	3	1	4
	16	2	3	5
	17	1	5	6
	18	0	3	3
	19	1	5	6
	21	0	1	1
	23	0	1	1
25	0	1	1	
Synthetic Language	20	0	1	1
	21	0	2	2
	22	0	2	2
	23	0	1	1
	24	0	3	3
	25	20	21	41

TABLE I (continued)
 FREQUENCY DISTRIBUTIONS OF THE SCORES

Tests	Scores	Frequencies		
		Examiner 1 20 Subjects	Examiner 2 30 Subjects	Combined 50 Subjects
Retention-Comprehension	45	0	1	1
	63	0	1	1
	67	0	1	1
	70	1	0	1
	71	0	1	1
	72	1	1	2
	74	0	1	1
	75	3	0	3
	76	1	1	2
	77	1	0	1
	78	3	0	3
	79	1	3	4
	81	0	1	1
	82	0	1	1
	83	1	0	1
	84	1	1	2
	85	0	1	1
	86	1	2	3
	88	0	2	2
	89	0	1	1
	91	0	1	1
	92	0	1	1
	94	0	4	4
	95	6	5	11

Score	SO Subjects Examined	SO Subjects Examined	SO Subjects Examined
22	0	0	0
23	0	0	0
24	0	0	0
25	0	0	0
26	0	0	0
27	0	0	0
28	0	0	0
29	0	0	0
30	0	0	0
31	0	0	0
32	0	0	0
33	0	0	0
34	0	0	0
35	0	0	0
36	0	0	0
37	0	0	0
38	0	0	0
39	0	0	0
40	0	0	0
41	0	0	0
42	0	0	0
43	0	0	0
44	0	0	0
45	0	0	0
46	0	0	0
47	0	0	0
48	0	0	0
49	0	0	0
50	0	0	0
51	0	0	0
52	0	0	0
53	0	0	0
54	0	0	0
55	0	0	0
56	0	0	0
57	0	0	0
58	0	0	0
59	0	0	0
60	0	0	0
61	0	0	0
62	0	0	0
63	0	0	0
64	0	0	0
65	0	0	0
66	0	0	0
67	0	0	0
68	0	0	0
69	0	0	0
70	0	0	0
71	0	0	0
72	0	0	0
73	0	0	0
74	0	0	0
75	0	0	0
76	0	0	0
77	0	0	0
78	0	0	0
79	0	0	0
80	0	0	0

Reference-Compilation

Score	SO Subjects Examined	SO Subjects Examined	SO Subjects Examined
22	0	0	0
23	0	0	0
24	0	0	0
25	0	0	0
26	0	0	0
27	0	0	0
28	0	0	0
29	0	0	0
30	0	0	0
31	0	0	0
32	0	0	0
33	0	0	0
34	0	0	0
35	0	0	0
36	0	0	0
37	0	0	0
38	0	0	0
39	0	0	0
40	0	0	0
41	0	0	0
42	0	0	0
43	0	0	0
44	0	0	0
45	0	0	0
46	0	0	0
47	0	0	0
48	0	0	0
49	0	0	0
50	0	0	0
51	0	0	0
52	0	0	0
53	0	0	0
54	0	0	0
55	0	0	0
56	0	0	0
57	0	0	0
58	0	0	0
59	0	0	0
60	0	0	0
61	0	0	0
62	0	0	0
63	0	0	0
64	0	0	0
65	0	0	0
66	0	0	0
67	0	0	0
68	0	0	0
69	0	0	0
70	0	0	0
71	0	0	0
72	0	0	0
73	0	0	0
74	0	0	0
75	0	0	0
76	0	0	0
77	0	0	0
78	0	0	0
79	0	0	0
80	0	0	0

AVERAGE DISCRIMINATIONS OF THE SCORES

(Percentages) TABLE I

TABLE I (continued)
 FREQUENCY DISTRIBUTIONS OF THE SCORES

Tests	Scores	Frequencies		
		Examiner 1 20 Subjects	Examiner 2 30 Subjects	Combined 50 Subjects
Vocabulary-Antonyms	2	1	2	3
	3	0	3	3
	4	1	4	5
	5	0	4	4
	6	1	1	2
	7	2	4	6
	8	0	1	1
	9	5	2	7
	10	3	3	6
	11	2	3	5
	12	3	1	4
	13	0	1	1
	14	2	1	3
	Word Knowledge	0	7	10
1		3	9	12
2		7	4	11
3		1	3	4
4		1	1	2
5		1	1	2
Reasoning	0	1	4	5
	1	4	5	9
	2	7	7	14
	3	8	14	22

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TABLE I (continued)
 FREQUENCY DISTRIBUTIONS OF THE SCORES

Tests	Scores	Frequencies		
		Examiner 1 20 Subjects	Examiner 2 30 Subjects	Combined 50 Subjects
Perception	13	0	1	1
	15	3	0	3
	18	0	2	2
	20	1	0	1
	21	2	3	5
	22	0	2	2
	24	4	1	5
	26	2	4	6
	28	0	1	1
	29	1	1	2
	30	2	0	2
	31	0	2	2
	33	2	1	3
	35	1	1	2
	36	0	1	1
	38	0	1	1
	40	1	2	3
	42	0	1	1
	45	1	0	1
	46	0	1	1
	48	0	1	1
	49	0	1	1
	50	0	1	1

TABLE I (continued)
 FREQUENCY DISTRIBUTIONS OF THE SCORES

Tests	Scores	Frequencies		
		Examiner 1 20 Subjects	Examiner 2 30 Subjects	Combined 50 Subjects
Rote II (Nonsense 1)	5	*	3	*
	6		4	
	7		3	
	8		1	
	10		1	
	12		7	
	14		1	
	15		3	
	16		1	
	17		3	
	18		2	
24		1		
Rote II (Nonsense 2)	12	*	1	*
	14		2	
	15		5	
	16		2	
	17		3	
	18		6	
	19		2	
	21		2	
	24		1	
	26		1	
	28		1	
30		3		
31		1		

*The scores of the twenty subjects are omitted because the two examiners did not follow the same instructions.

TABLE I (continued)

Date	Scores	No. of examinees	
		Examined	Passed
1947	100	1	1
1948	100	1	1
1949	100	1	1
1950	100	1	1
1951	100	1	1
1952	100	1	1
1953	100	1	1
1954	100	1	1
1955	100	1	1
1956	100	1	1
1957	100	1	1
1958	100	1	1
1959	100	1	1
1960	100	1	1
1961	100	1	1
1962	100	1	1
1963	100	1	1
1964	100	1	1
1965	100	1	1
1966	100	1	1
1967	100	1	1
1968	100	1	1
1969	100	1	1
1970	100	1	1
1971	100	1	1
1972	100	1	1
1973	100	1	1
1974	100	1	1
1975	100	1	1
1976	100	1	1
1977	100	1	1
1978	100	1	1
1979	100	1	1
1980	100	1	1
1981	100	1	1
1982	100	1	1
1983	100	1	1
1984	100	1	1
1985	100	1	1
1986	100	1	1
1987	100	1	1
1988	100	1	1
1989	100	1	1
1990	100	1	1
1991	100	1	1
1992	100	1	1
1993	100	1	1
1994	100	1	1
1995	100	1	1
1996	100	1	1
1997	100	1	1
1998	100	1	1
1999	100	1	1
2000	100	1	1
2001	100	1	1
2002	100	1	1
2003	100	1	1
2004	100	1	1
2005	100	1	1
2006	100	1	1
2007	100	1	1
2008	100	1	1
2009	100	1	1
2010	100	1	1
2011	100	1	1
2012	100	1	1
2013	100	1	1
2014	100	1	1
2015	100	1	1
2016	100	1	1
2017	100	1	1
2018	100	1	1
2019	100	1	1
2020	100	1	1
2021	100	1	1
2022	100	1	1
2023	100	1	1
2024	100	1	1
2025	100	1	1

TABLE I (continued)

TABLE I (continued)

TABLE II

MEANS AND STANDARD DEVIATIONS OF THE SCORES, WITH THE STANDARD ERRORS
OF THE MEAN FOR THE COMBINED SAMPLES

Tests	Number of Subjects	Means	Standard Deviations	Standard Errors of the Mean
Digit Span I	20	8.150	0.654	0.137
	30	7.850	0.964	
	50	8.380	0.957	
Digit Span II	20	8.400	0.735	0.119
	30	8.867	0.846	
	50	8.680	0.835	
Digit Span III	20	8.800	0.600	0.127
	30	8.833	1.035	
	50	8.820	0.888	
Digit Span IV	20	9.050	0.740	0.114
	30	8.867	0.846	
	50	8.940	0.810	
Digit Substitute	20	7.600	1.020	0.144
	30	8.533	0.806	
	50	8.160	1.007	
Comprehension I	20	13.100	5.138	0.685
	30	10.967	4.347	
	50	11.820	4.795	

TABLE 11

MEAN AND STANDARD DEVIATION OF THE SCORES, WITH THE STANDARD ERROR OF THE MEAN FOR THE DOMESTIC SAMPLES

Year	Number of Subjects	Mean	Standard Deviation	Standard Error of the Mean
1911-12	30	87.0	10.0	1.83
1912-13	30	88.7	10.0	1.83
1913-14	30	85.0	10.0	1.83
1914-15	30	84.0	10.0	1.83
1915-16	30	84.0	10.0	1.83
1916-17	30	84.0	10.0	1.83
1917-18	30	84.0	10.0	1.83
1918-19	30	84.0	10.0	1.83
1919-20	30	84.0	10.0	1.83
1920-21	30	84.0	10.0	1.83
1921-22	30	84.0	10.0	1.83
1922-23	30	84.0	10.0	1.83
1923-24	30	84.0	10.0	1.83
1924-25	30	84.0	10.0	1.83
1925-26	30	84.0	10.0	1.83
1926-27	30	84.0	10.0	1.83
1927-28	30	84.0	10.0	1.83
1928-29	30	84.0	10.0	1.83
1929-30	30	84.0	10.0	1.83
1930-31	30	84.0	10.0	1.83
1931-32	30	84.0	10.0	1.83
1932-33	30	84.0	10.0	1.83
1933-34	30	84.0	10.0	1.83
1934-35	30	84.0	10.0	1.83
1935-36	30	84.0	10.0	1.83
1936-37	30	84.0	10.0	1.83
1937-38	30	84.0	10.0	1.83
1938-39	30	84.0	10.0	1.83
1939-40	30	84.0	10.0	1.83
1940-41	30	84.0	10.0	1.83
1941-42	30	84.0	10.0	1.83
1942-43	30	84.0	10.0	1.83
1943-44	30	84.0	10.0	1.83
1944-45	30	84.0	10.0	1.83
1945-46	30	84.0	10.0	1.83
1946-47	30	84.0	10.0	1.83
1947-48	30	84.0	10.0	1.83
1948-49	30	84.0	10.0	1.83
1949-50	30	84.0	10.0	1.83
1950-51	30	84.0	10.0	1.83
1951-52	30	84.0	10.0	1.83
1952-53	30	84.0	10.0	1.83
1953-54	30	84.0	10.0	1.83
1954-55	30	84.0	10.0	1.83
1955-56	30	84.0	10.0	1.83
1956-57	30	84.0	10.0	1.83
1957-58	30	84.0	10.0	1.83
1958-59	30	84.0	10.0	1.83
1959-60	30	84.0	10.0	1.83
1960-61	30	84.0	10.0	1.83
1961-62	30	84.0	10.0	1.83
1962-63	30	84.0	10.0	1.83
1963-64	30	84.0	10.0	1.83
1964-65	30	84.0	10.0	1.83
1965-66	30	84.0	10.0	1.83
1966-67	30	84.0	10.0	1.83
1967-68	30	84.0	10.0	1.83
1968-69	30	84.0	10.0	1.83
1969-70	30	84.0	10.0	1.83
1970-71	30	84.0	10.0	1.83
1971-72	30	84.0	10.0	1.83
1972-73	30	84.0	10.0	1.83
1973-74	30	84.0	10.0	1.83
1974-75	30	84.0	10.0	1.83
1975-76	30	84.0	10.0	1.83
1976-77	30	84.0	10.0	1.83
1977-78	30	84.0	10.0	1.83
1978-79	30	84.0	10.0	1.83
1979-80	30	84.0	10.0	1.83
1980-81	30	84.0	10.0	1.83
1981-82	30	84.0	10.0	1.83
1982-83	30	84.0	10.0	1.83
1983-84	30	84.0	10.0	1.83
1984-85	30	84.0	10.0	1.83
1985-86	30	84.0	10.0	1.83
1986-87	30	84.0	10.0	1.83
1987-88	30	84.0	10.0	1.83
1988-89	30	84.0	10.0	1.83
1989-90	30	84.0	10.0	1.83
1990-91	30	84.0	10.0	1.83
1991-92	30	84.0	10.0	1.83
1992-93	30	84.0	10.0	1.83
1993-94	30	84.0	10.0	1.83
1994-95	30	84.0	10.0	1.83
1995-96	30	84.0	10.0	1.83
1996-97	30	84.0	10.0	1.83
1997-98	30	84.0	10.0	1.83
1998-99	30	84.0	10.0	1.83
1999-00	30	84.0	10.0	1.83
2000-01	30	84.0	10.0	1.83
2001-02	30	84.0	10.0	1.83
2002-03	30	84.0	10.0	1.83
2003-04	30	84.0	10.0	1.83
2004-05	30	84.0	10.0	1.83
2005-06	30	84.0	10.0	1.83
2006-07	30	84.0	10.0	1.83
2007-08	30	84.0	10.0	1.83
2008-09	30	84.0	10.0	1.83
2009-10	30	84.0	10.0	1.83
2010-11	30	84.0	10.0	1.83
2011-12	30	84.0	10.0	1.83
2012-13	30	84.0	10.0	1.83
2013-14	30	84.0	10.0	1.83
2014-15	30	84.0	10.0	1.83
2015-16	30	84.0	10.0	1.83
2016-17	30	84.0	10.0	1.83
2017-18	30	84.0	10.0	1.83
2018-19	30	84.0	10.0	1.83
2019-20	30	84.0	10.0	1.83
2020-21	30	84.0	10.0	1.83
2021-22	30	84.0	10.0	1.83
2022-23	30	84.0	10.0	1.83
2023-24	30	84.0	10.0	1.83
2024-25	30	84.0	10.0	1.83
2025-26	30	84.0	10.0	1.83
2026-27	30	84.0	10.0	1.83
2027-28	30	84.0	10.0	1.83
2028-29	30	84.0	10.0	1.83
2029-30	30	84.0	10.0	1.83
2030-31	30	84.0	10.0	1.83
2031-32	30	84.0	10.0	1.83
2032-33	30	84.0	10.0	1.83
2033-34	30	84.0	10.0	1.83
2034-35	30	84.0	10.0	1.83
2035-36	30	84.0	10.0	1.83
2036-37	30	84.0	10.0	1.83
2037-38	30	84.0	10.0	1.83
2038-39	30	84.0	10.0	1.83
2039-40	30	84.0	10.0	1.83
2040-41	30	84.0	10.0	1.83
2041-42	30	84.0	10.0	1.83
2042-43	30	84.0	10.0	1.83
2043-44	30	84.0	10.0	1.83
2044-45	30	84.0	10.0	1.83
2045-46	30	84.0	10.0	1.83
2046-47	30	84.0	10.0	1.83
2047-48	30	84.0	10.0	1.83
2048-49	30	84.0	10.0	1.83
2049-50	30	84.0	10.0	1.83
2050-51	30	84.0	10.0	1.83
2051-52	30	84.0	10.0	1.83
2052-53	30	84.0	10.0	1.83
2053-54	30	84.0	10.0	1.83
2054-55	30	84.0	10.0	1.83
2055-56	30	84.0	10.0	1.83
2056-57	30	84.0	10.0	1.83
2057-58	30	84.0	10.0	1.83
2058-59	30	84.0	10.0	1.83
2059-60	30	84.0	10.0	1.83
2060-61	30	84.0	10.0	1.83
2061-62	30	84.0	10.0	1.83
2062-63	30	84.0	10.0	1.83
2063-64	30	84.0	10.0	1.83
2064-65	30	84.0	10.0	1.83
2065-66	30	84.0	10.0	1.83
2066-67	30	84.0	10.0	1.83
2067-68	30	84.0	10.0	1.83
2068-69	30	84.0	10.0	1.83
2069-70	30	84.0	10.0	1.83
2070-71	30	84.0	10.0	1.83
2071-72	30	84.0	10.0	1.83
2072-73	30	84.0	10.0	1.83
2073-74	30	84.0	10.0	1.83
2074-75	30	84.0	10.0	1.83
2075-76	30	84.0	10.0	1.83
2076-77	30	84.0	10.0	1.83
2077-78	30	84.0	10.0	1.83
2078-79	30	84.0	10.0	1.83
2079-80	30	84.0	10.0	1.83
2080-81	30	84.0	10.0	1.83
2081-82	30	84.0	10.0	1.83
2082-83	30	84.0	10.0	1.83
2083-84	30	84.0	10.0	1.83
2084-85	30	84.0	10.0	1.83
2085-86	30	84.0	10.0	1.83
2086-87	30	84.0	10.0	1.83
2087-88	30	84.0	10.0	1.83
2088-89	30	84.0	10.0	1.83
2089-90	30	84.0	10.0	1.83
2090-91	30	84.0	10.0	1.83
2091-92	30	84.0	10.0	1.83
2092-93	30	84.0	10.0	1.83
2093-94	30	84.0	10.0	1.83
2094-95	30	84.0	10.0	1.83
2095-96	30	84.0	10.0	1.83
2096-97	30	84.0	10.0	1.83
2097-98	30	84.0	10.0	1.83
2098-99	30	84.0	10.0	1.83
2099-00	30	84.0	10.0	1.83
2100-01	30	84.0	10.0	1.83

TABLE II (continued)

MEANS AND STANDARD DEVIATIONS OF THE SCORES, WITH THE STANDARD ERRORS
OF THE MEAN FOR THE COMBINED SAMPLES

Tests	Number of Subjects	Means	Standard Deviations	Standard Errors of the Mean
Comprehension II	20	14.150	5.703	0.779
	30	12.400	5.401	
	50	13.100	5.453	
Card Span I	20	7.900	1.179	0.185
	30	9.033	1.117	
	50	8.580	1.298	
Card Span II	20	8.500	1.118	0.180
	30	9.100	1.300	
	50	8.860	1.261	
Prose Verbatim I	20	13.050	9.151	1.250
	30	13.500	8.465	
	50	13.320	8.749	
Prose Verbatim II	20	13.700	12.267	1.345
	30	13.467	6.791	
	50	13.560	9.413	
Prose Retention I	20	9.700	2.704	0.359
	30	11.267	2.159	
	50	10.640	2.512	

TABLE II (continued)

MEANS AND STANDARD DEVIATIONS OF THE SCORES, WITH THE STANDARD ERRORS
OF THE MEAN FOR THE COMBINED SAMPLES

Tests	Number of Subjects	Means	Standard Deviations	Standard Errors of the mean
Prose Retention II	20	9.800	2.441	
	30	11.267	2.081	
	50	10.680	2.345	0.335
Orientation	20	2.150	1.931	
	30	4.300	2.052	
	50	3.440	2.264	0.323
Memory Span Words	20	6.100	0.831	
	30	6.867	0.806	
	50	6.560	0.897	0.128
Completion	20	13.200	2.926	
	30	15.833	4.259	
	50	14.780	3.938	0.562
Synthetic Language	20	25.000	0.000	
	30	24.200	1.447	
	50	24.520	1.187	0.170
Retention-Comprehension	20	82.800	8.750	
	30	83.600	11.540	
	50	83.220	10.475	1.496

TABLE II (continued)

MEANS AND STANDARD DEVIATIONS OF THE SCORES, WITH THE STANDARD ERRORS
OF THE MEAN FOR THE COMBINED SAMPLES

Tests	Number of Subjects	Means	Standard Deviations	Standard Errors of the Mean
Vocabulary-Antonyms	20	9.350	2.971	
	30	7.033	3.391	
	50	7.960	3.423	0.489
Word Knowledge	20	1.450	1.394	
	30	1.567	1.745	
	50	1.520	1.616	0.231
Reasoning	20	2.100	0.889	
	30	2.033	1.080	
	50	2.060	1.008	0.144
Perception	20	26.500	7.864	
	30	31.200	9.934	
	50	29.320	9.472	1.353
Rote II (Nonsense 1)	30*	11.600	4.896	0.909
Rote II (Nonsense 2)	30*	19.500	5.408	1.004

*The scores of the twenty subjects are omitted because the two examiners did not follow the same instructions.

It was noted that for some of the tests the mean scores obtained by Examiner 1 differed somewhat from those secured by Examiner 2. Inspection of the two test groups revealed the fact that the group tested by the first examiner contained a relatively higher number of junior and senior students, while the other group was proportionately higher in the number of freshmen and sophomores tested. The numbers of college graduates tested and the range in ages of the two groups, however, were quite similar. With the exception of the vocabulary and completion items which might favor the upperclassmen, the nature of the tests is such that neither group should have any advantage.

As a check on the similarity of the sampling t-values were computed. The number of degrees of freedom is forty-eight since the twenty scores of one group are completely independent of the thirty scores of the other. For fifty degrees of freedom, the value of t must be 2.008 or greater to indicate significant differences at the five per cent level and 2.678 or larger at the one per cent level.

As shown in Table III, the only tests in which the two groups differed significantly at the one per cent level are Digit Span I, Digit Substitute, Card Span I, Orientation, and Memory Span for Words. In five additional tests -- Prose Retention I and II, Completion, Synthetic Language, and Vocabulary-Antonyms -- the t-ratios exceeded 2.008.

TABLE III

DIFFERENCES IN MEANS OBTAINED BY THE TWO EXAMINERS AND SIGNIFICANCE
OF DIFFERENCES AS DETERMINED BY t-RATIOS

Tests	Examiner	Means	Differences in the Means	Variance	t-ratios*
Digit Span I	1	7.850		0.285	
	2	8.733	0.833	0.930	3.498
Digit Span II	1	8.400		0.540	
	2	8.867	0.467	0.715	1.974
Digit Span III	1	8.800		0.360	
	2	8.833	0.033	1.072	0.126
Digit Span IV	1	9.050		0.548	
	2	8.867	0.183	0.715	0.771
Digit Substitute	1	7.600		0.933	
	2	8.533	0.933	0.649	3.529
Comprehension I	1	13.100		26.399	
	2	10.967	2.133	18.899	1.547
Comprehension II	1	14.150		32.525	
	2	12.400	1.750	29.173	1.075
Card Span I	1	7.900		1.390	
	2	9.033	1.133	1.249	3.366

*The critical ratios are 2.008 and 2.678 for the five per cent and one per cent levels respectively.

TABLE III (continued)

DIFFERENCES IN MEANS OBTAINED BY THE TWO EXAMINERS AND SIGNIFICANCE
OF DIFFERENCES AS DETERMINED BY t-RATIOS

Tests	Examiner	Means	Differences in the Means	Variance	t-ratios*
Card Span II	1	8.500		1.250	
	2	9.100	1.133	1.690	1.655
Prose Verbatim I	1	13.050		83.748	
	2	13.500	0.450	71.650	0.175
Prose Verbatim II	1	13.700		150.410	
	2	13.467	0.233	46.115	0.843
Prose Retention I	1	9.700		7.310	
	2	11.267	1.567	4.662	2.223
Prose Retention II	1	9.800		5.960	
	2	11.267	1.467	4.329	2.231
Orientation	1	2.150		3.728	
	2	4.300	2.150	4.210	3.641
Memory Span Words	1	6.100		0.690	
	2	6.867	0.767	0.649	3.191
Completion	1	13.200		8.560	
	2	15.833	2.633	18.139	2.363

*The critical ratios are 2.008 and 2.678 for the five per cent and one per cent levels respectively.

TABLE III. SUMMARY OF THE DATA OBTAINED FROM THE EXPERIMENTAL STUDY OF THE POLYMERIZATION OF STYRENE IN THE PRESENCE OF VARIOUS AMINO ACIDS.

Run	Time (hr)	Conversion (%)	M_w/M_n	M_w/M_n (theoretical)	Notes
1	1.0	100	1.00	1.00	Control
2	1.0	100	1.00	1.00	Control
3	1.0	100	1.00	1.00	Control
4	1.0	100	1.00	1.00	Control
5	1.0	100	1.00	1.00	Control
6	1.0	100	1.00	1.00	Control
7	1.0	100	1.00	1.00	Control
8	1.0	100	1.00	1.00	Control
9	1.0	100	1.00	1.00	Control
10	1.0	100	1.00	1.00	Control
11	1.0	100	1.00	1.00	Control
12	1.0	100	1.00	1.00	Control
13	1.0	100	1.00	1.00	Control
14	1.0	100	1.00	1.00	Control
15	1.0	100	1.00	1.00	Control
16	1.0	100	1.00	1.00	Control
17	1.0	100	1.00	1.00	Control
18	1.0	100	1.00	1.00	Control
19	1.0	100	1.00	1.00	Control
20	1.0	100	1.00	1.00	Control
21	1.0	100	1.00	1.00	Control
22	1.0	100	1.00	1.00	Control
23	1.0	100	1.00	1.00	Control
24	1.0	100	1.00	1.00	Control
25	1.0	100	1.00	1.00	Control
26	1.0	100	1.00	1.00	Control
27	1.0	100	1.00	1.00	Control
28	1.0	100	1.00	1.00	Control
29	1.0	100	1.00	1.00	Control
30	1.0	100	1.00	1.00	Control
31	1.0	100	1.00	1.00	Control
32	1.0	100	1.00	1.00	Control
33	1.0	100	1.00	1.00	Control
34	1.0	100	1.00	1.00	Control
35	1.0	100	1.00	1.00	Control
36	1.0	100	1.00	1.00	Control
37	1.0	100	1.00	1.00	Control
38	1.0	100	1.00	1.00	Control
39	1.0	100	1.00	1.00	Control
40	1.0	100	1.00	1.00	Control
41	1.0	100	1.00	1.00	Control
42	1.0	100	1.00	1.00	Control
43	1.0	100	1.00	1.00	Control
44	1.0	100	1.00	1.00	Control
45	1.0	100	1.00	1.00	Control
46	1.0	100	1.00	1.00	Control
47	1.0	100	1.00	1.00	Control
48	1.0	100	1.00	1.00	Control
49	1.0	100	1.00	1.00	Control
50	1.0	100	1.00	1.00	Control

TABLE III. SUMMARY OF THE DATA OBTAINED FROM THE EXPERIMENTAL STUDY OF THE POLYMERIZATION OF STYRENE IN THE PRESENCE OF VARIOUS AMINO ACIDS.

TABLE III (continued)

DIFFERENCES IN MEANS OBTAINED BY THE TWO EXAMINERS AND SIGNIFICANCE
OF DIFFERENCES AS DETERMINED BY t-RATIOS

Tests	Examiner	Means	Differences in the Means	Variance	t-ratios*
Synthetic Language	1	25.000		0.000	
	2	24.200	0.800	2.093	2.423
Retention-Comprehension	1	82.980		75.700	
	2	83.600	0.620	133.173	0.258
Vocabulary-Antonyms	1	9.350		8.828	
	2	7.033	2.317	11.499	2.435
Word Knowledge	1	1.450		1.943	
	2	1.567	0.117	3.046	0.246
Reasoning	1	2.100		0.790	
	2	2.033	0.067	1.166	0.226
Perception	1	26.500		89.044	
	2	31.200	4.700	98.693	1.741

*The critical ratios are 2.008 and 2.678 for the five per cent and one per cent levels respectively.

Account Statement

The following table sets out the balance sheet as at 31st Dec 1954

Particulars	1954	1953	1952	1951	1950
Assets					
Fixed Assets	100.0	100.0	100.0	100.0	100.0
Current Assets	100.0	100.0	100.0	100.0	100.0
Total Assets	200.0	200.0	200.0	200.0	200.0
Liabilities					
Capital	100.0	100.0	100.0	100.0	100.0
Reserves	100.0	100.0	100.0	100.0	100.0
Total Liabilities	200.0	200.0	200.0	200.0	200.0

OF DIFFERENCES, AS DETERMINED BY THE BOARD OF DIRECTORS AND STABILIZATION

TABLE III (continued)

Since significant differences were found between the two groups on some tests but not on others, the advisability of combining the two sets of data is open to question. The major consideration involved in this particular study is whether such combination materially affects the comparison between the hypoglycemic and normal scores of the special subject. After studying the effect of computing his standard scores from the data obtained for each of the subgroups separately, the use of the data from the combined groups was deemed justifiable. The results reported herein were obtained on that basis. All data necessary for computation from either norm have been presented in Tables I, II, and III. The tests were given to the special subject by Examiner 2.

Since significant differences were found between the two groups on some tests and not on others, the possibility of combining the two sets of tests to obtain a major consideration involves the question of whether such combining would be a distortion of the relationship between the hypothesis and actual scores on the subject. After checking the kind of relationship obtained from the data obtained for each of the tests separately, the use of the data from the two tests was deemed justifiable. The number of subjects obtained on each test was also necessary for comparison from either set of tests as shown in Table I, III. The tests were given to the subject.

Experiment 2.

TABLE I
RESULTS
OF TESTS
ON SUBJECTS

CHAPTER III

CRITICAL EVALUATION OF THE TESTS

In Chapter II it was shown that for ten of the tests differences between group performances great enough to be significant at the five per cent level were obtained. These differences may be due either to unequal ability of the two groups tested or to a variation in the technique of the examiners.

If the former were the cause, it would appear that other of the tests would exhibit similar and equally significant differences. For example, Card Span II should show a difference comparable to that of Card Span I, but it does not. Neither do the memory span tests using digits show differences as great as those using letters and words. Moreover, one of the examiners insists that a decided practice effect was revealed by the improvement in individual performance on the last two digit span tests when compared with the first two. The other examiner questions this statement. Obviously, each can cite the results he obtained to defend his point.

On the other hand several of the individual tests are particularly susceptible to variations arising from differences in examiners. The score which the subject makes on Digit Span I, the first test in the battery, depends to some

THE HISTORY OF THE UNITED STATES

In 1917, the United States entered the First World War. This was a significant event in the history of the world, as it marked the beginning of a global conflict that would last for four years. The United States joined the war on the side of the Allies, and its entry was a turning point in the conflict. The war had a profound impact on the United States, both in terms of its military and its domestic affairs.

The war was fought between the Central Powers and the Allies. The Central Powers included Germany, Austria-Hungary, and the Ottoman Empire. The Allies included the United States, France, Great Britain, and Italy. The war was fought in Europe, Africa, and Asia. The United States entered the war in 1917, and its entry was a significant event in the history of the world. The war had a profound impact on the United States, both in terms of its military and its domestic affairs. The war was fought between the Central Powers and the Allies. The Central Powers included Germany, Austria-Hungary, and the Ottoman Empire. The Allies included the United States, France, Great Britain, and Italy. The war was fought in Europe, Africa, and Asia. The United States entered the war in 1917, and its entry was a significant event in the history of the world. The war had a profound impact on the United States, both in terms of its military and its domestic affairs.

On the other hand, the war also had a profound impact on the United States. The war was fought between the Central Powers and the Allies. The Central Powers included Germany, Austria-Hungary, and the Ottoman Empire. The Allies included the United States, France, Great Britain, and Italy. The war was fought in Europe, Africa, and Asia. The United States entered the war in 1917, and its entry was a significant event in the history of the world. The war had a profound impact on the United States, both in terms of its military and its domestic affairs.

extent on the person giving the test. If he has made certain that the subject is interested in the outcome of the test and not ill-at-ease, he can expect to secure maximum performance. Performance on the memory span and orientation tests might be markedly influenced by differences in rhythm and rate of reading as well as in pronunciation. Inept handling of the cards could result in lower scores from the card span tests.

The criticisms set forth in this chapter do not offer explanations and solutions to the difficulties mentioned. Rather, they point out possible sources of variations inherent within the tests.

In reading the criticisms, it will be well to keep in mind the handicaps under which Captain Bradley worked. He had no access to a library -- no means of checking source material to confirm his opinions as to the relative difficulty of the items he selected. He had to rely solely on his memory and his judgment as to what constituted suitable test material. The scope of his experience in the field of mental testing could scarcely have been broad inasmuch as he was very young and had received little specialized training. Moreover, for many months he had undergone slow starvation, and he was hungry!

The series of tests, as presented in Chapter II, is obviously too long. The amount of information obtained

extent on the person who is the test. It is the same test-
 that has the subject is concerned in the degree of his
 test and not his test, he can expect to receive various
 performance. Therefore on the way that you are interested
 tests might be roughly indicated by differences in their
 and rate of reading as well as in grammatical. Some
 reading of the words could result in lower scores than the
 and your tests.

The criterion set forth in this chapter is not
 other explanations are necessary for the distinction
 formed. Again, they point out possible sources of vari-
 ations inherent within the tests.

In reading the criterion, it will be well to bear
 in mind the fact that when a subject is reading words
 He had no words in a library -- so many of these words
 referred to within his scope as to the relative diffi-
 culty of the items he selected. In fact, he only selects
 his words and his judgment as to their complexity is relative
 best material. The more of his experience in the field
 of mental testing again himself have been tested
 as he was very young and had received little specialized
 training. However, for many months he had been in the
 position, and he was happy.

The matter of tests, as presented in Chapter II, is
 obviously too long. The amount of information obtained

about the subject is insufficient to justify the amount of time spent in giving the complete test battery. This fact, however, tends to confirm rather than to deny the soundness of Captain Bradley's reasoning. Inevitably some of the test material would prove unsuitable. Additional test material would permit its discard. Into a single test series he incorporated possible equivalent forms -- a wise precaution since the survival of his subjects until a subsequent testing period was doubtful. This procedure gave two measurements of the individuals tested and at the same time provided for the preparation of parallel forms.

Too much attention is given to the rote memory type of testing, particularly the tests of memory span. That this should prove true of tests constructed under such handicaps is certainly to be expected. Probably no other type of test has been so widely used in intelligence testing as that of memory span for digits. Whether its popularity is deserved is, however, questionable. On the one hand it is specific as to the type of ability measured and is easy to construct, administer, and score. On the other, it is generally considered to be a rather poor measure of general intelligence. When there is a great preponderance of this type of test material, the brighter subjects tend to lose interest in their performance rather quickly. Wechsler has written that a good rote memory is

of practical value but correlates little with the higher levels of intelligence. Furthermore, he says, the memory span declines rapidly with increasing age, and some examiners report it to be influenced by fatigue. It is considered by some to be of value in picking out mental defectives, since a certain absolute minimum of this ability appears to be necessary.¹

Captain Bradley himself states that some of the tests are difficult to score. Some of them are. Others may be assailed as falling short of complete objectivity. Perhaps the over-all picture can best be shown by a discussion of the relative merits and defects of each type of test individually.

The digits in the digit span tests appear to be well randomized. No censure is attached to the construction of these tests. They simply have been given too much emphasis.

The digit substitute test, besides adding one more test to the memory span type, presents the problem of requiring the utmost care of the part of the examiner in pronouncing the letters. Did the subject respond with an I instead of a Y, a Z instead of C, or D instead of B because he did not hear the letter correctly? Is the

¹David Wechsler: The Measurement of Adult Intelligence. The Williams & Wilkins Company, Baltimore, 1944, pp. 83-5.

of practical value but... levels of intelligence... again declines rapidly... there report is to be... erred by some to be of value... since a certain... be necessary.

visually. The... randomized. No... these tests. The... The... test to the memory... regarding the... pronouncing the letters... I instead of a... because he did not...

decision required of the examiner in such a case both fair and accurate? Who could be certain?

Likewise the memory span for words test is a good test of the examiner's enunciatory ability. Aside from this, however, it is doubtful that the test has significance above other tests of the memory span. As a rule, the subjects do not like it. There appears to be some singularly irritating quality present. Perhaps this is occasioned by the feeling of frustration incurred by the inability of the subject to remember whether face belonged to this series or to the last one, or indeed if the word might not have been race. Whether a test of this type might prove to be a measure of how well the subject can limit associations is possibly worth investigation.

This test and the digit substitute are two of the four on which considerable variation in the mean scores of the separate samples were obtained. Perhaps differences in pronunciation by the examiners as well as the acuteness of the subject's hearing were reflected, especially since there was no means of judging the sounds from context.

The card span tests are, of course, more subject to the vagaries of chance than any of the others of the memory span type. That may be one reason why the subjects enjoyed taking them. During the course of testing, one of the examiners turned up a sequence of king, queen, jack, ten,

distal portion of the ...

and ...

... the ...

of the ...

every, it is ...

other ...

not like it. ...

quality ...

of ...

remember ...

last one, ...

Whether a ...

how well the ...

worth ...

This test ...

four on which ...

the separate ...

In ...

of the ...

there was no ...

The ...

the ...

exam type. ...

making ...

examiners ...

nine, followed by three fours and an ace. The subject called this combination correctly but was unable to give the numbers from nine cards arranged without sequence. While such a combination as this occurred only once, three consecutive cards having the same number, or numbers in ascending or descending order, happened rather frequently. Sometimes the subject failed to remember the card following such a combination; more often he named the entire group correctly. Despite this objection, it is noted that the coefficient of correlation for the two card span tests were found to be 0.795, a higher figure than that obtained for either Digit Span I and II, 0.622, or III and IV, 0.654.

The comprehension tests appear generally quite satisfactory, though the scoring is somewhat difficult. The ideas for which credit is to be given have been clearly marked. Still, subjectiveness in scoring cannot be eliminated, because the subjects do not always express the ideas with sufficient clarity for the examiner to be sure of the extent of the understanding. The highest scores were made by a physician and the next highest by a pre-medical student. However, since both subjects ranked above the averages throughout the entire series of tests, it cannot be shown that the nature of the test material gave them an advantage. A few subjects complained that they were handicapped because too many of the words used were

... followed by three trials and so on. The subjects
... called this combination especially for the purpose of 1930
... the numbers 1-20 also were arranged in a certain order.
... with such a combination as this occurred only once, three
... consecutive trials having the same number, or number in
... repeating or descending order, increased (Table 1, Appendix 1).
... sometimes the subject failed to remember the two trials
... for such a combination; more often he named the number from
... directly. Despite this objection, it is noted that the
... conditions of experiment for the two trials were quite
... found to be 0.75, a slight figure that was obtained for
... either right hand I and II, 0.80, or III and IV, 0.85.
... The combination tests appear generally to be
... satisfactory, though the matter is somewhat different. The
... than for which credit is to be given have been clearly
... varied. Still, subjectiveness in making tests to be
... stated, because the subjects do not always understand
... ideas with sufficient clarity for the experiment to be
... of the extent of the combination. The highest number
... were made by a physician and the next highest by a
... medical student. However, since both subjects tested during
... the averages throughout the entire series of tests, it
... cannot be shown that the nature of the test material gave
... them an advantage. A few subjects complained that they
... were handicapped because too many of the words used were

new to them.

The two prose verbatim tests are quite comparable. The gradation in level of difficulty appears somewhat steep, since less than one fourth of those succeeding at the eleven point level were able to repeat correctly either of the more difficult sentences.

In scoring, the three groups of orientation tests were combined, partly because this broadened the range of scores, and partly because the number of successes on the individual test items as shown below indicates some inequality in difficulty.

Group	Problem	Number of Successes
I	1	9
	2	11
	3	11
II	1	11
	2	11
	3	21
III	1	18
	2	35
	3	46

Though practice effect may have had some influence, it appears more likely that the manipulations of numbers and directions required are easier for the last four problems. If this be true, objection can be made to the order of presentation on the basis that increasing difficulty of the items would partially counteract the influence of practice effect. There was also the suggestion that the inclusion

may be said.

The first part of the paper is devoted to a discussion of the conditions under which the system is stable. It is shown that the system is stable if the gain is less than a certain value. This value is determined by the parameters of the system and the frequency of the input signal.

In addition, the stability of the system is also affected by the presence of noise. It is shown that the system is stable if the noise level is below a certain threshold. This threshold is determined by the parameters of the system and the frequency of the input signal.

Frequency	Gain	Stability
1	1	I
2	2	I
3	3	I
4	4	I
5	5	I
6	6	II
7	7	II
8	8	II
9	9	II
10	10	III
11	11	III
12	12	III

Through practical experience it is found that the system is stable if the gain is less than a certain value. This value is determined by the parameters of the system and the frequency of the input signal. It is also found that the system is stable if the noise level is below a certain threshold. This threshold is determined by the parameters of the system and the frequency of the input signal.

of so many items of this type seemed to reduce the interest value of the test series. As the orientation tests stand, there is insufficient gradation of difficulty to warrant the inclusion of all nine items; however, judging from the distribution of successes on the various items, there appears to be some likelihood that three equivalent groups containing three items each can be obtained.

The completion test is both interesting and varied in difficulty. Objectivity in scoring is generally insured by the nature of the sentences, though the blanks in sentence four offer such a variety of answers that some subjectivity is permitted. In sentence two, hydrochloric acid constitutes an answer suitable for both sets of blanks, though this was considered unacceptable in scoring. Muriatic acid, the other response expected, is coming into less and less use, even commercially. The illustrations used in the instructions pertaining to rhyming words contain the words irrigate and irritate, both suitable rhymes for the word activate of sentence ten. The instructions would have been equally clear if they had read, "for example, as a rhyme for confident, subsequent would be satisfactory, whereas rent would not." The illustration thus would have avoided a test item. Even so, the use of this illustration probably had little effect on the scores since there are so very many three-syllable words ending in ate; still some of

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 value of the series. As the orientation tests stand,
 there is insufficient prediction of difficulty to warrant
 the inclusion of all nine items; however, judging from the
 distribution of successes on the various items, there ap-
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 jectivity is permitted. In sentence two, psychological
said constituted an answer suitable for both sets of blanks,
 though this was considered unacceptable in scoring. Psychical
said, the other response expected, is coming into use and
 less use, even commensally. The illustrations used in the
 instructions pertaining to rhyming words contain the words
prize and prize, both suitable rhymes for the word
prize of sentence ten. The instructions would have been
 equally clear if they had read, "For example, as a rhyme
 for confident, embarrassed would be satisfactory, whereas
rent would not." The illustration thus would have avoided
 a test item. Even so, the use of this illustration prob-
 ably had little effect on the scores since there are so
 very many three-syllable words ending in ent; still some of

the subjects did ask if it was permissible to use the words given in the example. On the whole this seems a satisfactory test.

The frequency distribution of the scores for Synthetic Language shows at a glance that this test is too easy. The only errors made were substitutions of similar words, was for is, beautiful for pretty, and big for large. Nonetheless, this test has more interest value than the ordinary nonsense syllable type and might be of somewhat greater value in mental testing if the level of difficulty were properly adjusted. Either shortening the time permitted to study the list of words to two or three minutes or increasing the difficulty of the test to provide more discrimination of learning abilities is recommended.

To compile a list of nonsense syllables that would not suggest definite associations for some persons and not for others would be a difficult task. Without question, from this list APO had similar associations for all; unfortunately it was followed by ENO. This combination proved fatal to the scores of several veterans tested. They had served in the European Theatre of Operations and wrote ETO for ENO. Aside from this particular item, the list of syllables appears quite satisfactory. It is of sufficient length to insure an adequate range of measurement. The object in repeating the test using the same

the subjects did not find it as difficult as we had expected
given in the examples. The results of the test are given
factory test.

The frequency of use of the words in the
this language shows that the words are used in
easy. The only words were substituted in which
words, water, in, because, the, and the were
Kondratieva, the best and most interesting value was the
ordinary nonsense syllable gyls was used in the test
greater value in mental testing of the level of intelligence
were properly selected. When the words were substituted
ted to study the list of words so far as words selected in
increasing the difficulty of the test in the same way
discrimination of foreign syllables is concerned.
To compare a list of nonsense syllables that are
not suggest definite associations for some subjects and not
for others would be a difficult task. It is possible
from this list and other associations for this
unfortunately to be followed by gyls. This syllable
proved fatal to the minds of several subjects.
They had served in the business division of operations and
wrote HTO for HTO. This first syllable was
list of syllables appears with the syllable. It is
sufficient length to make it possible to use it in a
ment. The object in repeating the test was to show

list of syllables is not clear.

Besides requiring knowledge of the word meanings the Vocabulary-Antonyms demands some ingenuity in finding antonyms which serve the proper function as a part of speech. Witness the difficulty one encounters in selecting a noun whose meaning is opposite to catholicity. Or the problem presented the subject who could not supply a suitable antonym for carnivorous, "since vegetarian is a noun." The inclusion of the two words irrefutable and inhospitable is unsuitable, because the "opposites as far removed as possible from the meaning of the stimulus words" are clearly refutable and hospitable. Whether this was responsible for the guesses of "condite" and "calcitrant" as antonyms for recondite and recalcitrant cannot be determined. Even though the test appears difficult, the scores made were well distributed throughout the range. Rearrangement of the words in order of increasing difficulty is recommended because the presence of the most difficult words at the beginning tends to discourage some subjects before examination of the entire list is made.

The six words used in the word knowledge test are too near the same vocabulary level for this to be a satisfactory test. The inclusion of some easier words is needed.

The plant and speed problems are satisfactory in the reasoning test. The arithmetic problem assumes the role of

list of syllables to be written.

Besides counting syllables of the words written in the

Vocabulary-Inventory exercise some attention is directed

anonymously with the words in the words in the words in the

speech. Witness the difficulty in reading the words in the

a form whose meaning is opposite to the original. In the

problem presented the subject who reads the words in the

able anonymous for comparison. Words beginning with a vowel

The inclusion of the two words beginning with a vowel

is unavoidable, because the opposite of a word is not

possible from the position of the letter in the word. It is

retrograde and palindromic. Words beginning with a vowel

the phrases of "conscience" and "conscience" are not

reciprocal and palindromic. Words beginning with a vowel

though the test is not difficult, the words are

well distributed throughout the words. Words beginning with a vowel

words in order of increasing difficulty. Words beginning with a vowel

because the procedure of the test is not difficult. Words beginning with a vowel

beginning words to distinguish some and others. Words beginning with a vowel

nation of the entire list is also. Words beginning with a vowel

The six words each in the word beginning with a vowel

too near the same. Words beginning with a vowel

theory test. The inclusion of the words in the words in the

The clear and good evidence are not sufficient for the

reasoning test. The test is not difficult. Words beginning with a vowel

a memory test rather than one of reasoning. More problems of greater difficulty should be added, inasmuch as the frequency distribution shows that the upper range of abilities was not sufficiently covered.

The perception test proved the most popular in the entire series. The subjects reported that it was more interesting to take than the commonly used cross-out tests. It is also easier to score. The addition of more words to the vertical columns would improve the test. The most adept subjects quickly begin looking for the vowels, using these as signals to locate possible words.

The retention-comprehension test proved less difficult than was expected, since thirty per cent of the subjects made scores of 94 and 95. The test was generally liked, possibly because it aroused curiosity. Ambiguous wording at some points in the instructions caused confusion. For example, the instructions given in series C often resulted in the modification shown by Figure 2, page 50. The terminology "beneath and parallel" was seldom construed to require that the terminal points of line B lie in the same vertical planes as the end points of line A.

Certainly, the subjects who interpreted the instructions given in series E as indicated by Figure 3 pointed out a flaw in "drop a perpendicular of equal length to lines, A, B, and C." In fact, it might be contended that

A theory that states that the frequency of a sound is directly proportional to the wavelength of the sound. This is not necessarily correct.

The perception of sound is based on the amplitude of the sound waves. The amplitude of the sound waves is related to the loudness of the sound. The frequency of the sound waves is related to the pitch of the sound. The speed of sound is related to the medium through which the sound is traveling.

The relationship between the frequency and the wavelength of a sound wave is given by the equation $f = \frac{v}{\lambda}$, where f is the frequency, v is the speed of sound, and λ is the wavelength. This equation shows that the frequency of a sound wave is inversely proportional to its wavelength. The speed of sound is constant for a given medium, so the frequency and wavelength of a sound wave are inversely proportional to each other.

Certainly, the relationship between the frequency and the wavelength of a sound wave is a fundamental concept in acoustics. It is important to understand this relationship in order to understand the properties of sound waves and how they interact with the environment.

ILLUSTRATION II

The Geometric Figure Constructed
in the Retention-Comprehension
Test

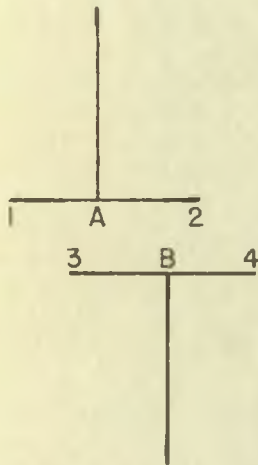


Figure 2

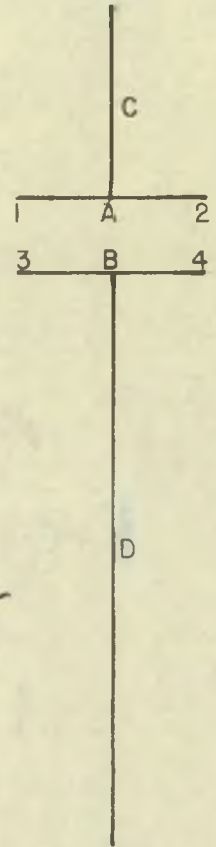


Figure 3

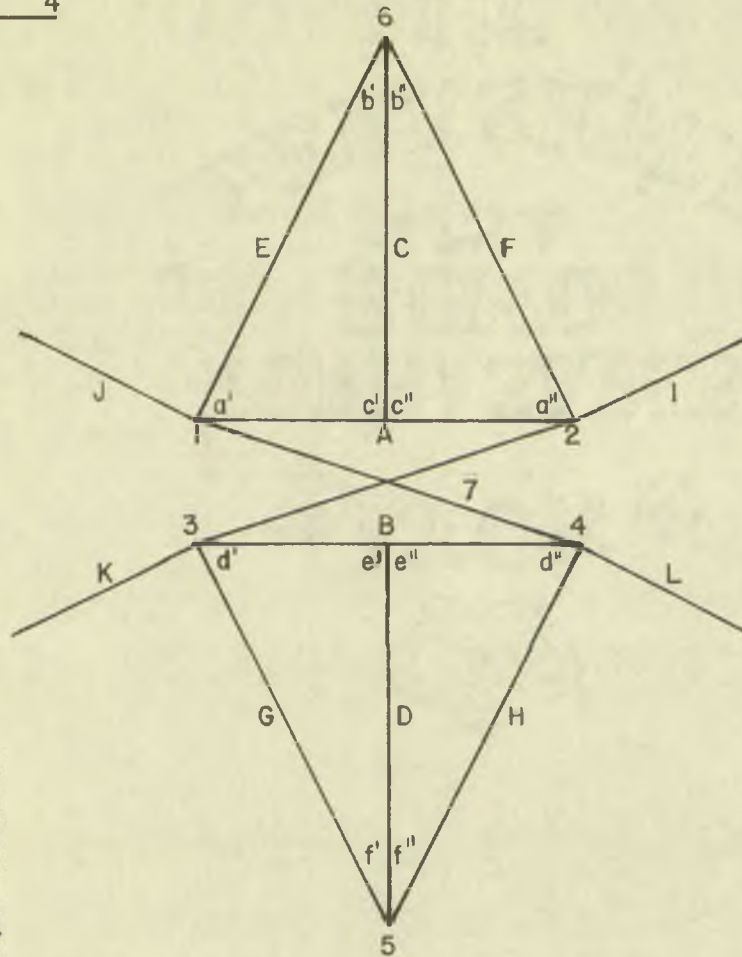


Figure 1

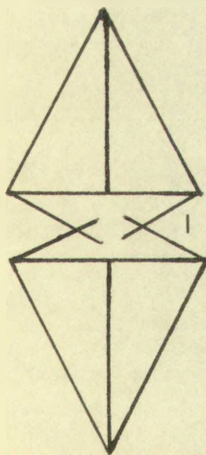


Figure 4

The Bradley Scoring Key Figure is shown by Figure 1. Figures 2, 3, and 4 show variations which the instructions of Series C, E, and K do not prohibit. See criticisms. The figures representing the variations have been drawn to half scale.

ILLUSTRATION 11

The geometric forms constructed in the Section-Comparison Test

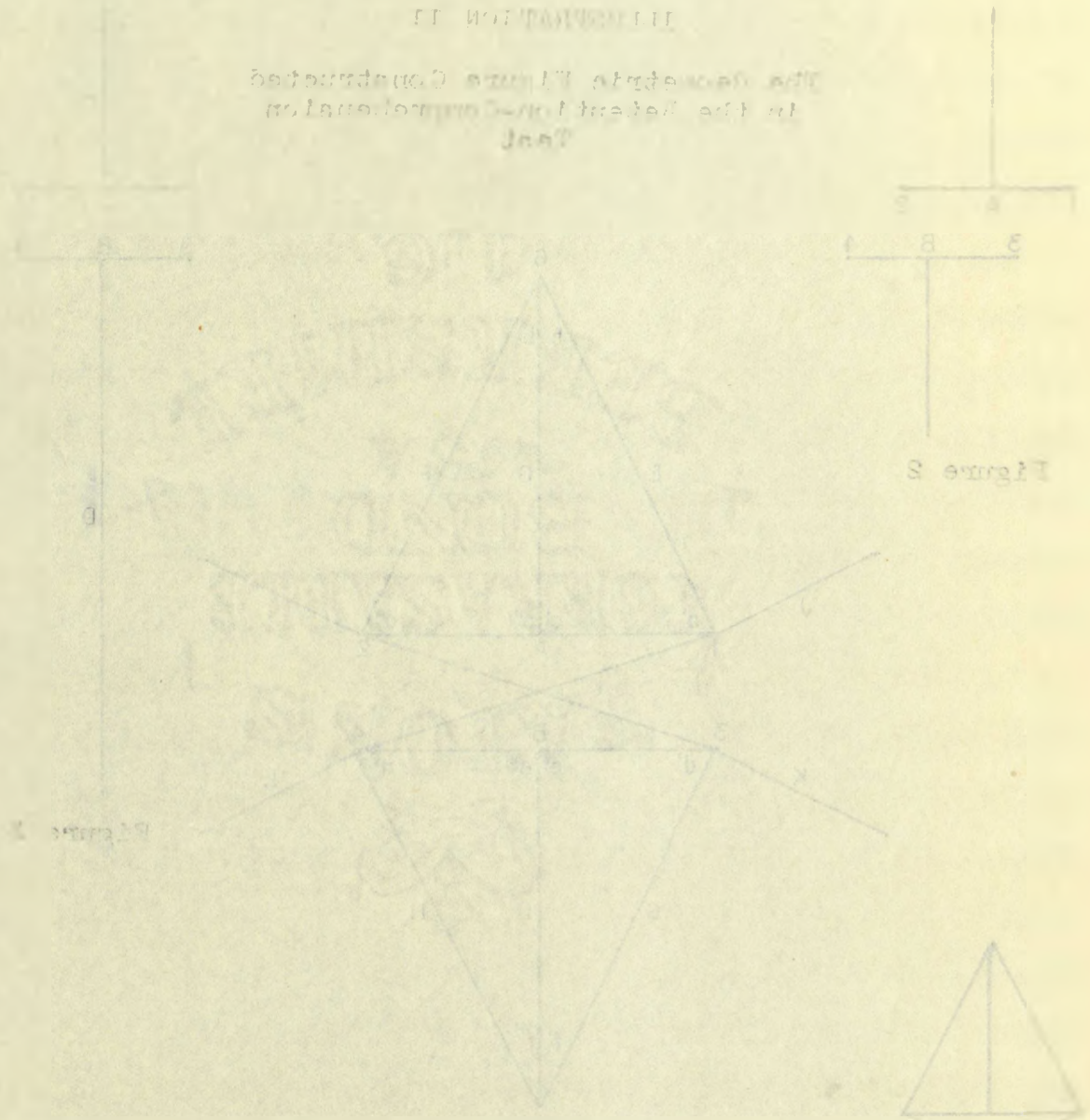


Figure 1

The angles between the lines in shown in Figure 1, Figures 2, 3, and 4 show variations which the instructions of Section 2, 3, and 4 do not prohibit. See captions. The lines represent the variations have been drawn to half scale.

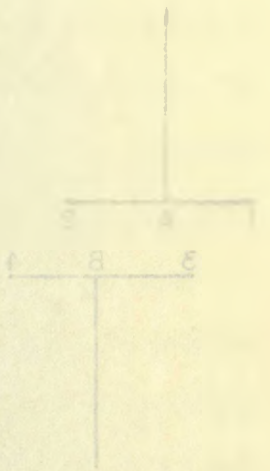


Figure 2



Figure 4

these were the only ones who made the correct interpretation. Yet they encountered difficulty in complying if, in accordance with the instructions of series A, they had drawn the first line centrally on the page. There was not sufficient room left for downward extension of the perpendicular to the extent demanded by the combined lengths of A, B, and C. The use of the word or rather than and in the instruction "A, B, and C" is suggested.

Series H gave considerable difficulty. Captain Bradley read the symbol a" as "a secant." This proved confusing to many of the subjects, especially those who had studied trigonometry. The correct terminology was found to be second, but the sound of the long e was retained to insure uniformity in the testing. Those who questioned were told that abbreviating or spelling out the word would be given full credit. However, some loss in retention may have resulted from this practice. Subsequent questioning of the subjects concerning their nomenclature for the symbol revealed that current usage appears to favor double prime. The substitution of such notation as a₁ and a₂ (or a² and a³) for a' and a'' is recommended, since this would eliminate the source of confusion without entailing the use of incorrect, and therefore objectionable, terminology.

The variation shown by Figure 4 was suggested by two subjects who had difficulty with the instructions

given in series K. As soon as he had completed the entire problem, one subject pointed to lines I, J, K, and L and asked, "Which was the right direction for these?" The other solved his dilemma by extending the perpendicular labeled I in both directions from the origin and explaining, "either way fits." Although alternative scoring might be allowed, it is not an altogether satisfactory solution since the source of confusion would not be removed. Besides, perpendiculars drawn as in Figure 4 would interfere somewhat with the intersecting lines called for in series N.

Most of the defects that have been pointed out are minor. In spite of them, the Bradley Tests appear to make some distinction between varying levels of ability among the college students and graduates tested. Through the use of these tests Captain Bradley has obtained data which can no longer be secured through the use of already established tests, such as the Stanford-Binet, since there is little likelihood that the conditions under which he worked will be duplicated, at least not until another war is fought. No further justification is needed for his tests.

Given in series N. As soon as the first problem, one subject failed to solve it, and asked, "which was the first problem?" The other solved his dilemma by examining the corresponding I in both diagrams, and then the original diagram, saying "way like". After this, the subject said in answer, it is not an identical situation. I noticed that the source of confusion was not in the diagrams, but in the diagrams given as in figure 1, which were numbered with the corresponding letters for the first part.

Most of the time, the subject gave the correct answer. In spite of that, the subject was asked to make some distinction between varying levels of ability among the college students in the same section. Later in the use of these tests, the subject had to make a distinction no longer be known to him. The use of these tests, such as the Stanford-Binet, since there is little likelihood that the same type of error would be repeated, he believed, at least not until another test is given. No further justification is needed for this belief.

CHAPTER IV

THE INFLUENCE OF HYPOGLYCEMIA ON THE TEST SCORES

In an attempt to discover whether hypoglycemia would materially affect mental test performance, the Bradley Tests were given to a subject singularly suited for such a study. Ordinarily his blood sugar level is kept within normal limits by means of a diet high in fats, supplemented by a light carbohydrate intake within three hours after meals. The standard six-hour glucose tolerance test showed the following blood sugar levels reported in milligrams per 100 cubic centimeters of blood: Fasting sugar, 63. After glucose feeding: 30 minutes, 111; 1 hour, 121; 2 hours, 116; 3 hours, 40; 4 hours, 52; 5 hours, 63; 6 hours 52. The normal range of concentration of the blood sugar for the fasting adult is 80 to 110 milligrams.² A rise in blood sugar content follows absorption from the intestinal tract, but the fasting level is reached again within three hours after food is taken. The laboratory report showed the blood sugar to be at the lowest level at this time. The subsequent rise is explained by conversion of stored glycogen into glucose. If food is withheld for longer periods, the clinical

²Kolmer, John A, and Boerner, Fred, Approved Laboratory Techniques. D. Appleton-Century Company, Inc., New York, 1941, p. 731.

history of the subject indicates that a further drop in the blood sugar level occurs, sometimes resulting in a physiological reaction similar to insulin shock. Taking these facts into consideration, the optimum time for testing in the hypoglycemic condition was judged to be between three and four hours after glucose feeding. The Bradley Tests, however, are too long to be given in so short a time. At least three such periods would be required. The subject certainly should not have to undergo the danger and the decidedly unpleasant after effects, such as especially severe headaches, of the lowered blood sugar any oftener than absolutely necessary for the study. If it could be shown from the data obtained by testing the fifty subjects that the different forms of the same type tests are equivalent, the number of abnormal testing periods could be cut to two through the use of parallel forms.

In order to determine whether the differences in the means of the two forms were sufficiently large to show actual differences in the tests, the t -ratios were computed. Since the scores which the fifty subjects made on one of the forms were not independent of the scores which the same fifty subjects made on the other form, it was necessary to determine the coefficients of correlation. Since these are also the reliability coefficients for the respective test forms, they furnish a suitable criterion for determining whether or not the tests may be considered equivalent. Table IV shows the

history of the subject indicates that a further study in the
blood sugar level occurs, somewhat resembling in a typical
logical reaction similar to insulin shock. During these tests
late consideration, the optimal time for testing in the hyper-
glycemic condition was found to be between three and four
hours after glucose loading. The insulin factor, however, was
too long to be given in so short a time. At least three and
periods would be required. The subject certainly should not
have to undergo the danger and the metabolic imbalance after
effects, such as especially severe reactions, of the insulin
blood sugar any other than essentially necessary for the
study. It could be shown from the data obtained in test-
ing the fifty subjects that the different forms of the same
type tests are equivalent, the number of standard deviations
periods could be cut in two through the use of parallel tests.
In order to determine whether the differences in the
means of the two tests were sufficiently large to show actual
differences in the tests, the t-test was computed. When
the scores which the fifty subjects made on one of the tests
were not independent of the scores which the same fifty sub-
jects made on the other test, it was necessary to determine
the coefficients of correlation. These tests are also the
reliability coefficients for the respective test forms. They
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the tests may be considered equivalent. Table IV shows the

TABLE IV

DIFFERENCES OF MEANS OF SIMILAR TEST FORMS AND THE SIGNIFICANCE
OF THE DIFFERENCES AS DETERMINED BY t-RATIOS

Tests	Means	Differences in Means	Standard Deviations	Coefficients of Correlation	Standard Errors of Means	t-Ratios*
Digit Span I	8.380		0.957	0.625	0.138	
Digit Span II	8.680	0.300	0.835	± 0.058	0.121	2.727
Digit Span III	8.820		0.888	0.654	0.128	
Digit Span IV	8.940	0.120	0.810	± 0.054	0.117	1.176
Comprehension I	11.820		4.795	0.861	0.692	
Comprehension II	13.100	1.280	5.401	± 0.025	0.787	3.137
Card Span I	8.580		1.298	0.795	0.187	
Card Span II	8.860	0.280	1.261	± 0.035	0.183	2.353
Prose Verbatim I	13.320		8.749	0.879	1.250	
Prose Verbatim II	13.560	0.240	9.413	± 0.022	1.345	0.373
Prose Retention I	10.640		2.512	0.907	0.359	
Prose Retention II	10.680	0.040	2.345	± 0.017	0.355	0.261
Rote II (Nonsense 1)	11.600		4.896	0.622	0.909	
Rote II (Nonsense 2)	19.500	7.900	5.408	± 0.058	1.022	8.643

*Critical ratios are 2.008 and 2.678 for the five per cent and one per cent levels respectively.

data. Strictly speaking, the coefficients of correlation used for computing the t-ratios should be the correlation between the means. Fortunately, as Guilford points out, the coefficients of correlation between tests can be used for this purpose.³ The number of degrees of freedom is 49, since the scores were obtained from fifty subjects. For fifty degrees of freedom, the t-value must be as much as 2.008 to indicate significant differences at the five per cent level, or 2.678 at the one per cent level. Inspection of Table IV shows absence of significant differences between the means of only three pairs of the tests. Nonetheless, consideration of the reliability coefficients in view of the small standard deviations seems to justify treatment of all the paired forms except the rote nonsense syllables as equivalent. This permitted testing with one of the test forms while the subject was in the normal state and with the other form while he was hypoglycemic. Tests for which no parallel form existed had to be given twice--once for each condition of the subject.

If all the tests were administered for the first time when the subject was in the normal state, the effect of practice might obliterate such differences as the hypoglycemia

³Guilford, J. P., Fundamental Statistics in Psychology and Education. McGraw-Hill Book Company, Inc., New York, 1942, pp. 137-40

might produce. Likewise, if all tests were given first during an abnormal condition, changes in scores might be attributed to practice effect. In order to get around this difficulty, four testing periods were required, the subject to be normal in the first and fourth periods and hypoglycemic in the second and third.

The order and plan of giving the tests was determined at random, with a few minor exceptions. For example, a given kind of test was always used once in the normal and once in the abnormal condition. The scores which the thirty subjects made during the second period of testing with the rote nonsense syllables were significantly different from their first scores, and the reliability coefficient of .622, in view of the size of the standard deviations, 5.408 and 4.896, was not considered sufficiently high to justify designating these as parallel tests. The Rote II(Nonsense) test was, therefore, necessarily given to the special subject in the normal state first. Then any score increase in his abnormal state would be in accord with findings from the group of subjects. Since, in fact, his score decreased in the abnormal state, this change could unquestionably be attributed to his condition, even if the amount of decrease is to a certain extent marked by the influence of practice. The best estimates available indicated that the special subject's test performance would at least equal that of the upper fifth of the subjects tested.

might produce. Likewise, in all tests were given, the
ing an abnormal condition, changes in scores might be attrib-
uted to practice effect. In order to control this effect,
only, four testing periods were required, and subjects
be normal in the first and fourth periods and abnormal
in the second and third.

The order and plan of giving the tests was determined
at random, with a few minor exceptions. For example, a
kind of test was always used once in the normal and once in
the abnormal condition. The scores which the thirty subjects
made during the second period of testing, with the same
sense syllables were significantly different from their first
scores, and the reliability coefficient of .823, in view of
the size of the standard deviations, 3.400 and 4.075, was not
considered sufficiently high to justify continuing them as
parallel tests. The Rose-Baltes test was, therefore,
necessarily given to the special subject in the normal state
first. Then any score increase in his abnormal state would
be in accord with findings from the group of subjects. Since,
in fact, his score decreased in the abnormal state, this
change could unquestionably be attributed to his condition,
even if the amount of decrease is to a certain extent
by the influence of practice. The test estimates which
indicated that the special subject's test performance was
at least equal that of the upper fifth of the subjects tested.

He made perfect scores at all levels above fourteen years on Form L of the 1937 Terman and Merrill Revision of the Stanford-Binet Scale, maintained high scholastic standing, and was considered by both the faculty and fellow students to have superior ability. In view of this, the expectation that he would make a score above ninety on the Retention-Comprehension Test was not unreasonable. In such a case, practice effect could not appreciably raise his normal score. It could, however, obliterate entirely any slight changes which the hypoglycemia might cause if permitted to operate in that direction. This fact necessitated giving this test for the first time when the subject was hypoglycemic. Since there are four tests of the digit span, one was assigned to each testing period. The final plan for giving the tests is shown in Table V. The hypoglycemic periods were scheduled one week apart so there would be no interference with the subject's work schedule. The testing with the condition of the subject normal was done two days preceding the first and two days following the last abnormal period.

On the days set for the hypoglycemic testing, the subject was fed two hundred grams of glucose (white corn syrup diluted with lemon juice for palatability) in lieu of his regular breakfast. This assured the production of the hypoglycemic state, since the digestive process would not be slowed down by the use of the simple sugar, though it might

He made perfect scores at all levels during the year
on Form I of the 1937 Stanford-Binet test.
Stanford-Binet test, and he had a high verbal score
and was considered by both the teacher and the parents
to have superior ability. In view of this, the hypothesis
that he would have a score above ninety on the Stanford-
Binet test was not unreasonable. In fact, the
practice effect could be expected to raise his verbal score.
It could, however, be expected to lower his verbal score
which the hypothesis at hand was expected to increase
in that direction. This fact was considered, but it was
for the first time when the subject was given the test
there are four tests of divergent thinking, and he was expected to
each testing period. The final schedule for testing the subject
is shown in Table I. The hypothesis is that the subject
one week apart to there would be no interference with the
subject's work schedule. The testing with the condition
the subject normal was done two days preceding the first and
two days following the last experimental session.
On the days set for the experimental testing, the
subject was for two hundred hours of glucose. When the
group diluted with lemon juice and water. The subject
his regular breakfast. This schedule was followed for the
hypoglycemic state, when the subject's glucose was
allowed down by the use of the sugar water. Table II shows

TABLE V

ORDER OF GIVING TESTS TO SPECIAL SUBJECT TO CONTROL PRACTICE EFFECT

Test	Condition	Period	Test	Condition	Period
Digit Span I	Normal	1	Digit Span III	Abnormal	3
Digit Span II	Abnormal	2	Digit Span IV	Normal	4
Comprehension I	Normal	1	Card Span I	Abnormal	2
Comprehension II	Abnormal	2	Card Span II	Normal	4
Prose Verbatim I	Normal	1	Prose Retention I	Abnormal	2
Prose Verbatim II	Abnormal	3	Prose Retention II	Normal	4
Memory Span Words	Abnormal	3	Digit Substitute	Normal	1
	Normal	4		Abnormal	2
Completion	Abnormal	3	Retention-Comprehension	Abnormal	2
	Normal	4		Normal	4
Synthetic Language	Normal	1	Perception	Normal	1
	Abnormal	3		Abnormal	3
Vocabulary-Antonyms	Abnormal	2	Word Knowledge	Normal	1
	Normal	4		Abnormal	3
Rote II (Nonsense 1)	Normal	1	*Orientation	Abnormal	2
(Nonsense 2)	Abnormal	2		Normal	Special
				Abnormal	3
Reasoning	Abnormal	2	*For these tests control could be best achieved by introducing a normal period between the two hypoglycemic periods.		
	Normal	4			

ORDER OF GIVING KEYS TO CERTAIN PATROLS OF POLICE TO CONTROL PUBLIC SAFETY

A BIRTH

Patrol	Condition	Year	Patrol	Condition	Year
1	Patrol	1911	1	Patrol	1911
2	Patrol	1912	2	Patrol	1912
3	Patrol	1913	3	Patrol	1913
4	Patrol	1914	4	Patrol	1914
5	Patrol	1915	5	Patrol	1915
6	Patrol	1916	6	Patrol	1916
7	Patrol	1917	7	Patrol	1917
8	Patrol	1918	8	Patrol	1918
9	Patrol	1919	9	Patrol	1919
10	Patrol	1920	10	Patrol	1920
11	Patrol	1921	11	Patrol	1921
12	Patrol	1922	12	Patrol	1922
13	Patrol	1923	13	Patrol	1923
14	Patrol	1924	14	Patrol	1924
15	Patrol	1925	15	Patrol	1925
16	Patrol	1926	16	Patrol	1926
17	Patrol	1927	17	Patrol	1927
18	Patrol	1928	18	Patrol	1928
19	Patrol	1929	19	Patrol	1929
20	Patrol	1930	20	Patrol	1930

be if fats or proteins were used. The tests were begun two hours and forty-five minutes later. Interspersed among the items from the Bradley tests were items from Form M of the Revised Stanford-Binet Scale so that the performance on the latter tests might also be compared. Seventy minutes were required for the first abnormal testing period; the second took fifteen minutes longer.

Thirty minutes after the subject had been fed following the second abnormal period, a memory span test for digits was given to find out whether he would do as well as during the first normal period. He was again able to call nine digits correctly.

After all testing had been completed, the raw scores were converted into standard scores so that they might be directly compared. Cognizance is taken of the fact that comparisons based on standard scores are liable to error. For most of these tests, the distributions of the scores appear at least approximately normal. Therefore, equivalent standard scores should indicate relatively similar performance with respect to the means of the various tests. The scores are presented in Tables VI and VII, while Table VIII shows the differences between the normal and the hypoglycemic scores. In the Binet test, the subject was able to complete correctly all items through the average adult level but failed on approximately half of the items in the higher levels

in all cases to provide the best possible service to the public.
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TABLE VI

SCORES MADE BY THE SPECIAL SUBJECT WHEN TESTED IN THE NORMAL STATE

Tests	Mean of Fifty Scores	Subject's Raw Score	Difference	Standard Deviation	Subject's Standard Score
Digit Span I	8.380	9	0.620	0.957	0.64
Digit Span IV	8.940	10	1.060	0.810	1.24
Comprehension I	11.820	24	12.180	4.795	2.54
Card Span II	9.860	9	0.140	1.260	0.11
Prose Verbatim I	13.320	28	14.680	8.955	1.64
Prose Retention II	10.680	14	3.320	5.498	0.60
Rote II (Nonsense 1)	11.600	17	6.400	4.896	1.31
Memory Span Words *	6.560	7	0.440	0.897	0.49
Digit Substitute	8.160	9	0.840	1.007	0.83
Completion *	14.780	25	10.220	3.938	2.60
Synthetic Language	24.520	25	0.480	1.187	0.42
Retention-Comprehension *	83.220	95	11.780	10.475	1.12
Perception	29.320	42	12.680	9.472	1.34
Vocabulary-Antonyms *	7.960	13	5.040	3.423	1.49
Word Knowledge	1.520	5	3.480	1.616	2.15
Reasoning *	2.060	3	0.940	1.008	0.93
Orientation *	3.440	7	3.560	2.264	1.57

* Tests which were given for the first time when the subject was in the hypoglycemic state.

Score
 * These items have been taken from the 1948-49 year and are subject to the same conditions.

Item	Score	Year	Reference	Weight	Score
Calculation *	8.40	1	0.80	1.00	8.40
Conversion *	8.00	2	0.80	1.00	8.00
Word problem	1.430	2	3.40	1.00	4.82
Application-Formulas *	1.400	12	2.80	0.80	1.12
Calculation	8.880	48	18.00	0.80	14.40
Percentage-Completion	22.880	32	11.80	0.80	9.44
Percentage Problem	24.880	32	0.80	1.00	24.88
Completion *	14.880	32	10.80	0.80	8.64
Word problem	8.100	6	0.80	1.00	8.10
Word problem	0.800	1	0.80	1.00	0.80
Word II (Reverse J)	11.000	11	6.00	1.00	11.00
Word problem II	10.800	14	2.80	0.80	8.64
Word problem I	12.880	32	14.80	0.80	11.90
Word II	0.800	6	0.80	1.00	0.80
Completion I	11.880	36	12.80	0.80	10.30
Word problem IA	8.840	10	1.00	0.80	7.07
Word problem I	0.880	6	0.80	1.00	0.88

Item	Score	Year	Reference	Weight	Score
Calculation *	8.40	1	0.80	1.00	8.40
Conversion *	8.00	2	0.80	1.00	8.00
Word problem	1.430	2	3.40	1.00	4.82
Application-Formulas *	1.400	12	2.80	0.80	1.12
Calculation	8.880	48	18.00	0.80	14.40
Percentage-Completion	22.880	32	11.80	0.80	9.44
Percentage Problem	24.880	32	0.80	1.00	24.88
Completion *	14.880	32	10.80	0.80	8.64
Word problem	8.100	6	0.80	1.00	8.10
Word problem	0.800	1	0.80	1.00	0.80
Word II (Reverse J)	11.000	11	6.00	1.00	11.00
Word problem II	10.800	14	2.80	0.80	8.64
Word problem I	12.880	32	14.80	0.80	11.90
Word II	0.800	6	0.80	1.00	0.80
Completion I	11.880	36	12.80	0.80	10.30
Word problem IA	8.840	10	1.00	0.80	7.07
Word problem I	0.880	6	0.80	1.00	0.88

SCORES MADE BY THE SUBJECTS WHEN TESTED IN THE MATHS EXAM

PAGE VI

TABLE VII

SCORES MADE BY THE SPECIAL SUBJECT WHEN TESTED IN THE HYPOGLYCEMIC STATE

Tests	Mean of Fifty Scores	Subject's Raw Score	Difference	Standard Deviation	Subject's Standard Score
Digit Span I	8.380	7	- 1.680	0.835	- 2.01
Digit Span III	8.820	6	- 2.820	0.888	- 3.18
Comprehension II	13.100	13	- 0.100	5.453	- 0.02
Card Span I	8.580	6	- 2.580	1.298	- 1.99
Prose Verbatim II	13.540	0	- 13.540	9.378	- 1.44
Prose Retention I	10.640	7	- 3.640	2.512	- 1.45
Rote II (Nonsense 2)	19.500	10	- 9.500	5.408	- 1.76
Word Span	6.560	4	- 2.560	0.806	- 3.18
Digit Substitute*	8.160	6	- 2.160	1.007	- 1.83
Completion	14.780	16	1.320	3.938	0.34
Synthetic Language*	24.520	22	- 2.520	1.187	- 2.12
Retention-Comprehension	83.220	71	- 12.220	10.475	- 1.83
Perception*	29.320	17	- 12.320	9.472	- 1.30
Vocabulary-Antonyms	7.960	7	- 0.960	3.391	- 0.27
Word Knowledge*	1.520	2	0.480	1.616	0.30
Reasoning	2.060	1	- 1.060	1.008	- 1.05
Orientation**	3.440	1	- 2.440	2.264	- 1.08

*Tests given for the first time when the subject was in the normal state.

**The score reported is the average of the scores obtained during the two hypoglycemic periods.

TABLE VIII

DIFFERENCES BETWEEN NORMAL AND HYPOGLYCEMIC SCORES

Test	Standard Scores Normal	Test	Standard Scores Hypoglycemic	Difference
Digit Span I	0.64	Digit Span II	- 2.01	2.65
Digit Span IV	1.24	Digit Span III	- 3.18	4.42
Comprehension I	2.54	Comprehension II	- 0.02	2.56
Card Span II	0.11	Card Span I	- 1.99	2.10
Prose Verbatim I	1.64	Prose Verbatim II	- 1.44	3.08
Rote II (Nonsense 1)	1.31	Rote II (Nonsense 2)	- 1.76	3.07
Prose Retention II	0.60	Prose Retention I	- 1.45	2.05
Memory Span Words	0.49	Memory Span Words *	- 3.18	3.67
Digit Substitute *	0.83	Digit Substitute	- 2.14	2.97
Completion	2.60	Completion *	0.34	2.26
Synthetic Language *	0.42	Synthetic Language	- 2.12	2.54
Retention-Comprehension	1.12	Retention-Comprehension *	- 1.83	2.95
Perception *	1.34	Perception	1.30	2.64
Vocabulary-Antonyms	1.49	Vocabulary-Antonyms *	- 0.27	1.76
Word Knowledge *	2.15	Word Knowledge	0.30	1.85
Reasoning	0.93	Reasoning *	- 1.05	1.98
Orientation	1.57	Orientation **	- 1.08	2.65

* This designates the first time these tests were given.

** The score reported is the average of the scores obtained in the two hypoglycemic periods.

The following table shows the results of the tests performed on the samples of the material under investigation. The results are given in the form of a table, the columns of which are headed as follows:

Sample No.	Material	Temperature	Time	Weight	Volume	Specific Gravity
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
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31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50

Sample No.	Material	Temperature	Time	Weight	Volume	Specific Gravity
51
52
53
54
55
56
57
58
59
60

DIFFERENCES BETWEEN MOUNTED AND UNMOUNTED SPECIMENS

PLATE VIII

when he was hypoglycemic. His I.Q. as determined by the method applicable to adults--a dubious procedure--fell from 152 on Form L taken in the normal condition to 119 on Form M taken during the hypoglycemic state.

While even casual inspection shows the differences in the scores to be quite large, whether they can be attributed entirely to the low blood sugar level has not been shown. Analysis of variance was used to find out whether the order of giving the tests was a significant factor in the results obtained. The scores on the Word Knowledge and Reasoning Tests were ignored in making this analysis because these tests have too limited a range of difficulty to be considered adequate measuring instruments. Since the subject made the same score on the Orientation Test during the second hypoglycemic period as during the first, the treatment shown by Table IX is considered suitable. The F-ratio obtained, 0.309, is, of course, not significant.* Therefore, the influence of the order in which the tests were given was inconsequential.

Differences in the measuring ability of the individual tests, it might be argued, could have contributed just as much to the differences in scores as did the change in the subject's condition. Again analysis of variance was used to

* Strictly speaking, F-ratios less than one are not computed. It was done here to clinch an argument.

TABLE IX

ANALYSIS OF VARIANCE TO DETERMINE WHETHER THE ORDER OF ADMINISTERING THE TESTS CAUSED ANY SIGNIFICANT DIFFERENCES IN TEST PERFORMANCE

Order	Normal Condition		Abnormal Condition		Sum
	Test	Score	Test	Score	
1	Digit Span I	0.64	Digit Span III	- 3.18	
	Comprehension I	2.54	Card Span I	- 1.99	
	Prose Verbatim I	1.64	Prose Retention I	- 1.45	
	Rote II (Nonsense 1)	1.31	Retention-Comprehension	- 1.83	
	Digit Substitute	0.83	Completion	0.34	
	Synthetic Language	0.42	Vocabulary-Antonyms	- 0.27	
	Perception	1.34	Orientation	- 1.43	
			Memory Span Words	- 3.18	
	Sum	8.72	-12.99	- 4.27	
2	Digit Span IV	1.24	Digit Span II	- 2.01	
	Card Span II	0.11	Comprehension II	- 0.02	
	Prose Retention II	0.60	Prose Verbatim II	- 1.44	
	Retention-Comprehension	1.12	Rote II (Nonsense 2)	- 1.76	
	Completion	2.60	Digit Substitute	- 2.14	
	Vocabulary-Antonyms	1.49	Synthetic Language	- 2.12	
	Orientation	1.57	Perception	- 1.30	
	Memory Span Words	0.49			
	Sum	9.22	-10.79	- 1.57	
	TOTAL	17.94	-23.78	- 5.84	

Code	Leaf	Score	Code	Leaf	Score
1	General	1.00	1	General	1.00
2	Administrative	1.00	2	Administrative	1.00
3	Technical	1.00	3	Technical	1.00
4	Professional	1.00	4	Professional	1.00
5	Executive	1.00	5	Executive	1.00
6	Supervisory	1.00	6	Supervisory	1.00
7	Operative	1.00	7	Operative	1.00
8	Unskilled	1.00	8	Unskilled	1.00
9	Service	1.00	9	Service	1.00
10	Other	1.00	10	Other	1.00
11	Specialized	1.00	11	Specialized	1.00
12	Highly Specialized	1.00	12	Highly Specialized	1.00
13	Very Specialized	1.00	13	Very Specialized	1.00
14	Extremely Specialized	1.00	14	Extremely Specialized	1.00
15	Unspecialized	1.00	15	Unspecialized	1.00
16	General	1.00	16	General	1.00
17	Administrative	1.00	17	Administrative	1.00
18	Technical	1.00	18	Technical	1.00
19	Professional	1.00	19	Professional	1.00
20	Executive	1.00	20	Executive	1.00
21	Supervisory	1.00	21	Supervisory	1.00
22	Operative	1.00	22	Operative	1.00
23	Unskilled	1.00	23	Unskilled	1.00
24	Service	1.00	24	Service	1.00
25	Other	1.00	25	Other	1.00
26	Specialized	1.00	26	Specialized	1.00
27	Highly Specialized	1.00	27	Highly Specialized	1.00
28	Very Specialized	1.00	28	Very Specialized	1.00
29	Extremely Specialized	1.00	29	Extremely Specialized	1.00
30	Unspecialized	1.00	30	Unspecialized	1.00

THE SIGNIFICANT DIFFERENCES IN LEAF REPRESENTATION
 ARE DETERMINED BY THE ORDER OF ADMINISTERING THE LEAF CHANGED
 SYSTEM

PAGE IX

TABLE IX (continued)

ANALYSIS OF VARIANCE TO DETERMINE WHETHER THE ORDER OF ADMINISTERING THE TESTS CAUSED ANY SIGNIFICANT DIFFERENCES IN TEST PERFORMANCE

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F-Ratio
Total	79.4856	29	-	-
Condition	58.0187	1	-	-
Order	0.2431	1	0.2431	0.309
Remainder	21.2238	27	0.7861	-

Registered
 Capital
 Surplus
 Total

\$1,888,000
 1,888,000
 1,888,000
 4,664,000

24
 7
 7
 38

0.1207
 0.8493

-
 0.608
 -
 -

Source of Information

Sum of Dollars

Number of Shares

Per Share

1-1-1970

THE SIGNIFICANT DIFFERENCES IN THE INFORMATION
 AVAILABLE TO DELEGATES HEREIN ARE ORDER OF PRECEDENCE AND ARE AS FOLLOWS:

TABLE IX (continued)

check the hypothesis. The results are recorded in Table X. The F-ratios obtained show that both the inequalities of the tests and the change in the condition of the subject were significant factors in effecting the differences in scores. However, the hypoglycemia is shown to be the major influence. Compare the F-ratio obtained for tests, 5.90 to the 2.80 which is significant at the one per cent level for 14 and 14 degrees of freedom. Then make the comparison for the influence of condition--261.23 obtained to 8.86 required for significance at the one per cent level.

Since the effects of both condition and tests were found to be significant, it was deemed appropriate to apply the t-test in order to determine where the significant differences lay.⁴ As shown by Table X, the mean square of the remainder (or error) term is 0.2221. The best estimate of the standard deviation of the experimental error is, therefore, $\sqrt{0.2221}$ or 0.4712. The standard error of the mean is 0.4712 divided by $\sqrt{2}$ or 0.333, since only two measurements were obtained for each test. Likewise the standard error of the difference is 0.333, since multiplying by one ($\sqrt{1/2 + 1/2}$) does not affect the value. With 14 degrees of freedom in the error term, the smallest t-value that could be considered significant at the one per cent level is 2.977.

⁴Freeman, H. A., Industrial Statistics. John Wiley & Sons, Inc., New York, 1942, p. 62.

check the hypothesis. The results are reported in Table 1. The F-ratios obtained are very low, the probability of the tests and the chance of a significant difference is very small. However, the hypothesis is shown to be true for the F-ratios. Compare the F-ratios obtained for each of the two groups which is significantly above the two percent level for the degrees of freedom. Then, the comparison for the two groups of conditions--80:20 obtained for the two percent level of significance at the one percent level.

Since the effects of both conditions are not significant, found to be significant. It was found that the differences in the F-test in order to determine where the differences are significant. The mean scores of the remainder (or error) term is 0.000. The last estimate of the standard deviation of the error term is 0.000. Therefore, $\sqrt{0.000}$ or 0.000. The standard error of the mean is 0.000 divided by $\sqrt{2}$ or 0.000, since only two measurements were obtained for each test. Likewise, the standard error of the difference is 0.000, since only two measurements of $(\sqrt{2} + \sqrt{2})$ does not affect the error term. The F-ratios of freedom in the error term, the critical values for each test be considered significant at the one percent level in Table 1.

TABLE X

ANALYSIS OF VARIANCE TO DETERMINE WHETHER THE CONDITION OF THE SUBJECT AND INEQUALITIES AMONG THE TESTS CAUSED ANY SIGNIFICANT DIFFERENCES IN THE SCORES

Normal Condition		Abnormal Condition		
Test	Score	Test	Score	Sum
Digit Span I	0.64	Digit Span II	- 2.01	- 1.37
Digit Span IV	1.24	Digit Span III	- 3.18	- 1.94
Comprehension I	2.54	Comprehension II	- 0.02	2.52
Card Span II	0.11	Card Span I	- 1.99	- 1.88
Prose Verbatim I	1.64	Prose Verbatim II	- 1.44	0.20
Prose Retention II	0.60	Prose Retention I	- 1.45	- 0.85
Rote II (Nonsense 1)	1.31	Rote II (Nonsense 2)	- 1.76	- 0.45
Memory Span Words	0.49	Memory Span Words	- 3.18	- 2.69
Retention-Comprehension	1.12	Retention-Comprehension	- 1.83	- 0.71
Digit Substitute	0.83	Digit Substitute	- 2.14	- 1.31
Completion	2.60	Completion	0.34	2.94
Synthetic Language	0.42	Synthetic Language	- 2.12	- 1.70
Vocabulary-Antonyms	1.49	Vocabulary-Antonyms	- 0.27	1.22
Perception	1.34	Perception	- 1.30	0.04
Orientation	1.57	Orientation	- 1.43	0.14
Sum	17.94		-23.78	- 5.84

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F-Ratio
Total	79.4856	29	-	-
Tests	18.3581	14	1.3113	5.904
Condition	58.0187	1	58.0187	261.228
Remainder	3.1088	14	0.2221	-

Hence a difference in the standard scores greater than $0.334 \times 2.977 = 0.991$ indicates significant differences between tests. Comparisons can be made from Table VIII, page 63. For example, in the normal state, significant differences are observed between Digit Span I and both Comprehension I and Completion. Further inspection of this kind shows that there are no tests which do not differ significantly from at least two others in the battery. This type of comparison could be carried out to show every instance in which the score made by the subject on one test varied significantly from his score on another. The data in this case, however, does not justify the tedium involved in making such minute comparisons. In general, it can be stated that the subject scored significantly higher on the Comprehension and Completion Tests than on tests of the memory span type.

Similar comparisons made on the hypoglycemic scores show that significantly higher scores were made on the Comprehension, Completion, and Vocabulary-Antonym tests. The inference might be drawn that the vocabulary was affected less by the hypoglycemia than other factors tested; however, the relative standing of the normal and hypoglycemic scores was changed so slightly that no test can be singled out as measuring a type of mental ability which hypoglycemia did not affect.

Hence a difference in the standard scores of 0.535 x 2.979 = 1.591 indicates a significant difference between tests. Comparison can be made with Table 1, page 55. For example, in the word test, significant differences are observed between Digit Span 1 and Digit Span 2 and between Digit Span 1 and Digit Span 2. The results of this kind show that there are no significant differences of this kind between Digit Span 1 and Digit Span 2. The type of comparison could be carried out on any other instance in which the score made by the subject on one test varied significantly from his score on another. The data in this case, however, does not justify the finding involved in making such within comparisons. In general, it can be stated that the subject varied significantly between on the Digit Span 1 and Digit Span 2 tests and on tests of the memory span type.

Similar comparisons were made on the psychometric scores show that significantly higher scores were made on the Digit Span 1, Digit Span 2, and Digit Span 3 tests. The inference might be drawn that the vocabulary was affected less by the hypoxemia than other factors tested; however, the relative standing of the normal and hypoxic scores was changed so slightly that no test can be singled out as measuring a type of mental ability which hypoxemia did not affect.

By a similar process to that just cited, it was determined that any condition difference greater than 0.132 would occur by chance only one per cent of the time. Inasmuch as the smallest difference between normal and hypoglycemic scores for any test was 1.76 (Table VIII, page 63), the chief inference that can be drawn is that hypoglycemia interfered to such a great extent in all the types of mental processes measured by the Bradley Tests that it is impossible to determine from this study whether there are any mental abilities which remain unaffected by the condition.

By a similar process to that just cited, it was determined that any condition difference greater than 0.132 would occur by chance only one out of ten times. Inasmuch as the smallest difference between normal and hypoglycemic scores for any test was 1.75 (Table VIII, page 63), the chief inference that can be drawn is that hypoglycemia interfered to such a great extent in all the types of mental processes measured by the Prudley tests that it is impossible to determine from this study whether there are any mental abilities which remain unaffected by the condition.

CHAPTER V

A SUMMARY OF THE CONCLUSIONS DRAWN FROM THIS STUDY

In spite of its faults, the Bradley test battery comprises a measuring instrument which appears to discriminate between different levels of superiority in mental ability. The memory span type of test probably does not merit the prominence it received, since it correlates rather poorly with other measurements of general ability. Too much time is required to administer the entire test series; however, the likelihood that the battery can be shortened without material loss in the efficacy of measurement appears good. At least, the presence of equivalent forms has been shown in five instances, and some necessity must be demonstrated in order to warrant the retention of both forms in a single battery. Some minor changes should be made in the instructions of the Retention-Comprehension and Vocabulary-Antonyms Tests.

In the special study, hypoglycemia was shown to cause a distinct reduction in the test scores. Failure to ingest proper nourishment between meals may result in a lowering of mental ability by more than 2.5 standard deviations. The effect of the lowered blood sugar was not confined to any particular type of ability but was reflected throughout the entire test battery. Obviously, the condition

A SUMMARY OF THE CONCLUSIONS DRAWN FROM THIS STUDY

In spite of the fact that the reading test battery comprises a number of different tests which appear to measure quite different levels of ability in reading ability, the battery as a whole does not merit the prominence it receives, since it consists rather poorly with other instruments of general ability. Too much time is required to administer the entire test series; however, the likelihood that the battery can be shortened without material loss in the ability of measurement appears good. At least a few of the individual components have been shown to be in line with general ability, and some possibly must be discarded in order to reduce the total time of both forms in a single sitting. Some other changes should be made in the instructions and the selection of comprehension and vocabulary items.

In the special study, the results were shown to cause a distinct reduction in the test scores. Further to suggest proper measurement between reading and general ability of general ability of more than 2.5 standard deviations. The effect of the lowered standard scores was not confined to any particular type of ability and was reflected throughout the entire test battery. Presumably the reading

constitutes a mental handicap. Unquestionably, it results in diminished awareness of the immediate environment.

Committee on the Administration of the Government
is directed to report to the President and the Senate

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APPENDIX

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Formulas Used in Computing t-Ratios

1. Table III, pp. 35-7

$$t = \frac{M_1 - M_2}{\sqrt{\frac{\sum d_1^2 + \sum d_2^2}{n_1 + n_2 - 2} \left(\frac{1}{n_1} + \frac{1}{n_2} \right)}}$$

2. Table IV, p.55

$$t = \frac{M_1 - M_2}{\sqrt{\sigma_{M_1}^2 + \sigma_{M_2}^2 - 2r_{12} \sigma_{M_1} \sigma_{M_2}}}$$

APPENDIX

Formulas Used in Computing t-Ratios

1. Table III, pp. 33-7



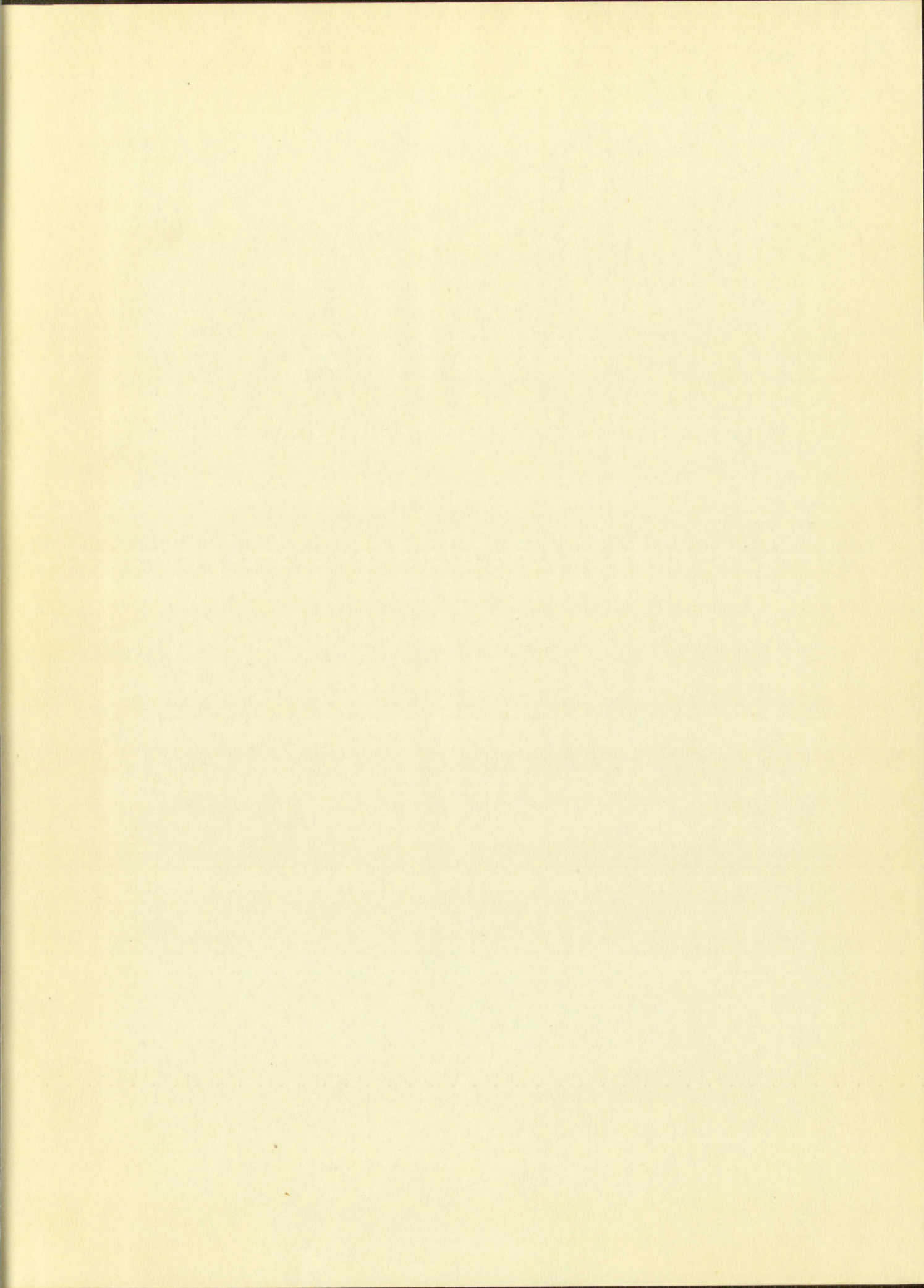
$$t = \frac{M_1 - M_2}{\sqrt{\frac{E_1^2 + E_2^2}{n_1 + n_2} (K_1 + K_2)}}$$

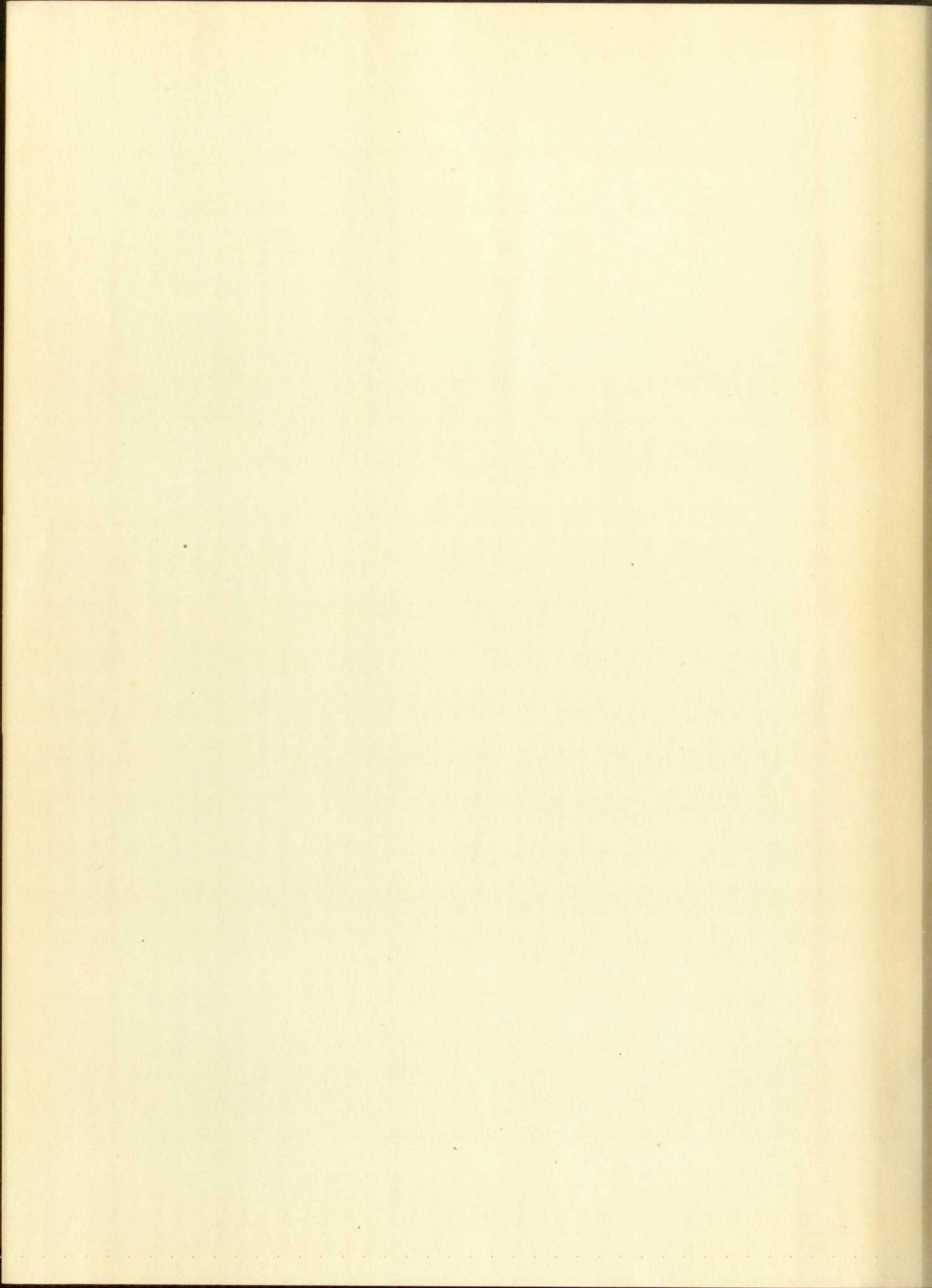
2. Table IV, p. 33

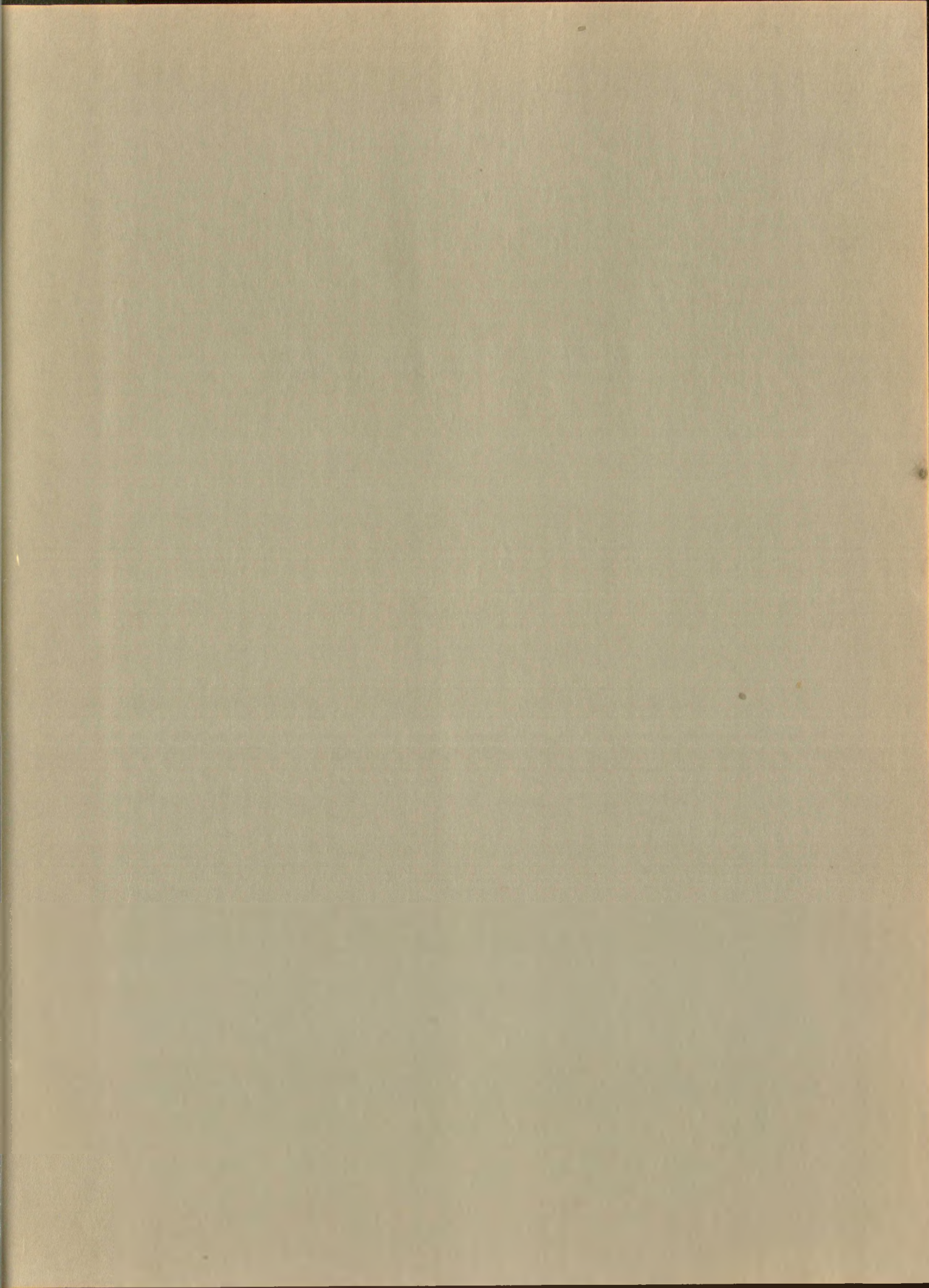
$$t = \frac{M_1 - M_2}{\sqrt{\frac{E_1^2 + E_2^2}{n_1 + n_2} (K_1 + K_2)}}$$

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