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Jan. 20, 26, 29, 30, and Mar[redacted]40

Summary of reports from the Trade Test Department.

Memorandum #4, Analysis of Item No. 26 in Form 1-R (I)
Memorandum #6, Relationship between Army Alpha Scores and Form 1-R (I) Scores
Memorandum #7, Further Considerations Regarding Form 1-R (I)
Memorandum #8, Prediction of Alpha Scores (Form 16) from Form 1-R (I) Scores
Memorandum #9, Analysis of Form 1-R (I) Scores Made in 30 Minutes.
Memorandum #15, Correlation of Short Alpha Scores with Form 1-R (I) Scores

Memorandum #4 (Memorandum right #4, 6-9 and 15.)

Correct response changed from #3 to #1 for item #26 on the basis of the percentage answering that way in two groups of 100 each.

Memorandum #6

Form 1-R (I) is a retest for men who failed Army Alpha.

205 recruits were given the test, 2-6 weeks subsequent to the original Alpha examination.

The Pearsonian coefficient of correlation was .843; probable error .013.

The regression equation is: $\bar{Y} = .46X - 4.34$, in which $\bar{Y}$ is the most probable Form 1-R (I) score predicted from an obtained Alpha score, and X is the actual original Alpha score. The standard error of estimate is 6.63.

It was suggested that a score of 39 or below on Form 1-R (I) be considered as failing.

Of the 205 taking the examination, 13, or 6.3%, scored below 92 on the Alpha and hence failed the original test. Of these 13, 11, or 84.6%, scored below 40. None scored above 42. In addition to the 11 men who failed the Alpha and scored below 40 on Form 1-R (I), 9 men who passed the Alpha (out of 192 who passed the Alpha) likewise scored below 40 on Form 1-R (I). However, of these 9, the highest Alpha score was 109 (83rd percentile).

A

Memorandum #7

A further analysis of the frequency distribution of Form 1-A (I) scores from same group as Memorandum #6.

Only additional information added to Memorandum #6 is that of the 205 men taking the re-examination, 7% scored 34 or below.

Memorandum #8

On the basis of scores made by the 205 enlisted men already discussed in Memoranda #6 and #7, the following regression equation was formulated:

$\bar{X} = 1.54Y - 42.24$, in which $\bar{X}$ is the predicted Alpha raw score (Form 16); and Y is the obtained Form 1-A (I) score. The standard error of estimate of this prediction is 12.10.

Memorandum #9.

90 enlisted recruits were given the Form 1-A (I); they had previously taken the Army Alpha.

The Pearsonian coefficient of correlation between the two variables was .689, with a probable error of .024.

The regression equation is: $\bar{Y} = .45X - 8.56$, in which $\bar{Y}$ is the predicted Form 1-A (I) score (time limit 30 minutes), and X is the actual raw score.

Memorandum #15

Two groups, one of 90 Chanute Field recruits who had been given the Alpha under wall-controlled conditions (called "Ex group", the other of 116 men who had been given the Alpha under conditions of doubtful validity (called the "Non-Ex Group") were given Form 1-A (I) 2-8 weeks later with the interval being appreciably smaller for the Ex Group than for the Non-Ex group. Short Alpha scores were computed by extracting scores made on the four Long Alpha tests which comprise the Short Alpha Examination.

The Pearsonian coefficient of correlation between the two distributions for the "Ex Group" is .91; for the "Non-Ex Group" .79.

For the "Ex Group" the regression equations are as follows:

$\bar{Y} = .69X - 1.47$, where $\bar{Y}$ is the predicted 1-R (I) score, and X is the actually obtained short Alpha score. The standard error of estimate is 5.22.

$\bar{X} = 1.19Y - 15.51$, where $\bar{X}$ is the predicted Short Alpha score, and Y is the actually obtained 1-R (I) score. The standard error of estimate is 6.88.

For the "Non-Ex Group", the regression equations are as follows:

$\bar{Y} = .59X - 5.88$, where $\bar{Y}$ is the predicted 1-R (I) score, and X is the actually obtained Short Alpha score. The standard error of estimate is 7.17.

$\bar{X} = 1.05Y - 24.07$, where $\bar{X}$ is the predicted Short Alpha score, and Y is the actually obtained 1-R (I) score. The standard error of estimate is 9.55.

As Form 1-R (I) was administered second, the scores may have been artificially raised because of practice effect. Accordingly, the predictions of Short Alpha scores from 1-R (I) scores must be interpreted with practice effect in mind.

January 20, 1940

Memorandum #4

Trade Test Department

Analysis of Item No. 26 in Form 1-R (I)

The item reads as follows:

26. OBSERVE is to MATCH as DEMONSTRATE is to:
1 ILLUSTRATE, 2 PROOF, 3 DEMONSTRATION,
4 WORK, 5 DISCERN ..... ( )

The correct answer, according to the test from which this item was selected, is #3. The seemingly correct answer is #1. In order to determine the scoring interpretation to be given this item when grading tests, an analysis of 200 answers to this item has been made, with the following results:

1. Two groups of 100 papers each were scored for Item 26. The percentages of persons in the first group who checked each of the five possible answers are as follows:

#1	86%		
#2	1		
#3	8	Unanswered:	1%
#4	0		
#5	4		

2. The percentages for the second group are:

#1	81%		
#2	1		
#3	12	Unanswered:	1%
#4	3		
#5	2		

3. Accordingly, it is suggested that answer #1 be selected as the correct response for this item. It is further suggested that a more recently published copy of the test from which this item was selected be obtained, in order to determine whether the apparent error has been corrected.

In case Form 1-A (I) should be expanded to five pages, instead of the present three, in order to facilitate the reading of the test by using larger print, it is suggested that an alternate item be substituted for the present Item 26, so that the ambiguity of the test may be lessened.

Memorandum #6 January 26, 1940

Trade Test Department

Relationship between Army Alpha Scores and Form 1-R (I) Scores

Problem: According to the revision of Air Corps Circular 35-7, dated November 18, 1939, enlisted men who fail to pass the entrance examination (Army Alpha) for the Air Corps Technical Schools may be re-examined at any time after an interval of three months from the date of the original examination. Because of test familiarity it would be advisable to administer the Army Alpha for a second time; hence an omnibus type of mental alertness test has been published for re-examination purposes. The problem is to determine the degree of relationship between Army Alpha scores and the new Form 1-R (I) scores, in order to compare scores made on the two tests, and to establish standards of passing or failure for the new examination.

Procedure: A group of 205 recruits was given the new Form 1-R (I) examination from two to six weeks subsequent to the original Alpha examination. The time for administering Form 1-R (I) was 20 minutes. Scores on this test were compared with raw Alpha scores previously made by the same group, with the following results:

1. The average (mean) Alpha score is 123.25. The average (mean) Form 1-R (I) score is 52.60.

2. The standard deviation of the Alpha score distribution is 22.27. The standard deviation of the Form 1-R (I) scores is 12.21.

3. The Pearsonian coefficient of correlation between the two sets

of scores is .843. The probable error of this coefficient is .013. This means that the chances are 50 out of 100 that the true coefficient of correlation lies between .830 and .856. It is practically certain (100 chances out of 100) that the true coefficient of correlation is between .791 and .895.

4. The regression equation is:

$$\bar{Y} = .46x - 4.34,$$

in which

$\bar{Y}$ = the most probable Form 1-R (I) score predicted from an obtained Alpha score, and

x = the actual original Alpha score.

5. Thus, the Alpha raw score just below the minimum passing grade is 92. By substituting 92 for x in the above equation, it will be seen that the most probable raw score an applicant with an Alpha raw score of 92 would make on Form 1-R (I) is 38.

6. How reliable is this prediction? The standard error of estimate is 6.63. This may be interpreted as follows:

a. An applicant who makes a score of 92 on the Alpha (just below passing) would probably make a score of 38 on Form 1-R (I). The chances are 68 in 100 that his score actually obtained on Form 1-R (I) would be between 31 and 45. The chances are 95 in 100 that his score actually obtained from Form 1-R (I) would lie between 25 and 51. We can only be certain (100 chances out of 100) that his score will be somewhere between 18 and 58.

b. This may be stated in another way. It may be expected that of all the applicants who score 92 on the Alpha and who take Form 1-R (I) as a re-examination, 68% will obtain Form 1-R (I) scores between 31 and 45; 16% will have scores greater than 45, and 16% will have scores lower than 31. This prediction is, of course, valid only for those who score 92 on the Alpha. Those who score lower on the Alpha may, of course, be expected to score lower on Form 1-R (I).

7. It has been suggested that a score of 39 or below on Form 1-A (I) be considered failing. If Form 1-A (I) were administered to an unselected group of recruits, 15% of the group would probably score below 40 - but, since there is not a perfect relationship between the two tests, not all of these would have failed the Alpha.

8. In the group of 205 enlisted men used in this study, 13, or 6.3% scored below 92 on the Alpha, and hence failed the original test. Of these 13, 11, or 84.6%, scored below 40 on the Form 1-A (I) test. None scored above 42.

9. In addition to the 11 men who failed the Alpha and scored below 40 on Form 1-A (I), 9 men who passed the Alpha (out of 192 who passed the Alpha) likewise scored below 40 on Form 1-A (I). However, of these 9, the highest Alpha score was 109 (83rd Percentile).

10. In using Form 1-A (I) as a re-examination, somewhat lower scores, in general, may appear than the scores made by this group, since the interval between the original Alpha test and the re-examination for this group was considerably less than three months, and the practice effect may have resulted in somewhat higher scores.

11. There would be no necessity of re-testing anyone with an Alpha score below 51, since the chances are practically 100 out of 100 that such an applicant would score below 40 on Form 1-A (I).

12. A more intensive study of applicants who failed the Alpha test is planned.

Memorandum #8

Trade Test Department.

Prediction of Alpha Scores (Form 16) from Form 1-A (I) Scores

On the basis of scores made by 205 enlisted men, already discussed in Memoranda #6 and #7, the following regression equation has been formulated:

$$\bar{X} = 1.54Y + 42.24,$$

in which

$\bar{X}$ is the predicted Alpha raw score (Form 16); and

Y is the obtained Form 1-A (I) score.

The standard error of estimate of this prediction is 12.10.

Thus, if an enlisted man makes a score of 52 on Form 1-A (I), his most probable Alpha score will be 122. The chances are 68 in 100 that it would fall between 98 and 146. It is practically certain that no man with a Form 1-A (I) score of 52 would score below 86 or above 158 on the Alpha test.

Memorandum #9. January 30, 1940

Trade Test Department.

Analysis of Form 1-A (I) Scores Made in 30 Minutes.

An unselected group of 90 enlisted recruits was given the Form 1-A (I) re-examination with a time limit of thirty minutes. These scores were compared with Alpha raw scores, and the results of the study are as follows:

1. Chart One is a scatter diagram to show the distribution of Form 1-A (I) and Alpha scores.

2. The Pearsonian coefficient of correlation between the two variables is .789, with a probable error of .024.

3. The regression equation is:

$$Y = .45X - 8.58$$

in which

Y is the predicted Form 1-A (I) score (time limit 30 minutes), and

X is the actual Alpha raw score.

4. The mean of the Form 1-A (I) scores is 65.37; the mean of the Alpha raw scores is 126.17. The latter average is above the mean Alpha score previously obtained; specifically, the difference is 3.88. This difference is not statistically significant.

5. The standard deviation of the Form 1-A (I) scores is 11.25; the standard deviation of the Alpha scores is 19.73.

6. Chart Two represents the frequency distribution of the 90 Form 1-A (I) raw scores.

Memorandum #15 March 6, 1940

Trade Test Department

Correlation of Short Alpha Scores with Form 1-A (I) Scores

Two groups of Chanute Field recruits were given the long form of the Alpha examination. One group, herein called "Ex Group," was given the examination under well-controlled experimental conditions. The second group, called the "Non-Ex Group," was given the examination under conditions of more doubtful validity.

In this study Short Alpha scores were computed by extracting scores made on the four Long Alpha tests which comprise the Short Alpha examination.

These two groups of recruits were later given a Form 1-A (I) test under good conditions. The interval between the Alpha test and the 1-A (I) test varied from two to eight weeks, the interval being appreciably smaller for the Ex Group than for the Non-ex Group.

In this study the Ex Group numbers 90, whereas the Non-Ex Group numbers 116.

Charts One and Two indicate the distribution of scores made by the two groups.

Results of this study are as follows:

(1) The means and standard deviations of the various tests and groups involved are:

	Short Alpha Scores		Form 1-A (I) Scores	
	Mean	S. D.	Mean	S. D.
"Ex Group"	77.23	16.18	51.73	12.27
"Non-Ex Group"	79.93	15.58	53.28	11.70

(2) The Pearsonian coefficient of correlation between the two distributions for the "Ex Group" is .91; for the "Non-Ex Group," .79. The difference between these two coefficients may be accounted for by faulty administration of the Alpha test; inaccurate scoring probably also plays a part. The scoring of the "Ex Group" Alpha examinations has been thoroughly checked.

(3) For the "Ex Group" the regression equations are as follows:

$\bar{Y} = .69x - 1.47$, where

$\bar{Y}$ is the predicted 1-R (I) score, and

X is the actually obtained Short Alpha score.

The standard error of estimate for this prediction is 5.22.

$\bar{X} = 1.19Y - 15.51$, where

$\bar{X}$ is the predicted Short Alpha score, and

Y is the actually obtained 1-R (I) score.

The standard error of estimate for this prediction is 6.88.

(4) For the "Non-Ex Group," the regression equations are as follows:

$\bar{Y} = .59X - 5.83$, where

$\bar{Y}$ is the predicted 1-R (I) score, and

X is the actually obtained Short Alpha score.

The standard error of estimate for this prediction is 7.17.

$\bar{X} = 1.05Y - 24.07$, where

$\bar{X}$ is the predicted Short Alpha score, and

Y is the actually obtained 1-R (I) score.

The standard error of estimate for this prediction is 9.55.

(5) Since Form 1-R (I) was administered second, the scores may have been artificially raised because of practice effect resulting from the previous administration of the Alpha examination. Accordingly, since the amount of practice effect is an unknown factor, the predictions of Short Alpha scores from 1-R (I) scores must be interpreted with practice effect in mind. That is, if an enlisted man is given first Form 1-R (I) and then the Short Alpha test, it is not reasonable to presume that the regression equations here given will have a great degree of validity or accuracy.