too good a psychologist to attempt to "sell" this idea to an academic audience.

In a time when many things seem uncertain, and there are some reasons for grave anxiety, hope and courage are found in the idea of the university, a center of research, of scientific idealism, of professional pride, and of loyalty to the community entering the field of public health. Here men and women are to be trained to serve their fellows, to help to bring in a better social order in which health shall be interpreted in ever wider and nobler ways. We cling still to the dream of Francis Bacon, the vision of a people served by a brotherhood of scholars who give themselves gladly that knowledge may enrich and bless the lives of all. May the American university strive always to deserve the verdict of the citizens of the New Atalantis upon Salomon's House, "the noblest foundation, as we think, that was ever upon the earth, and the lantern of this kingdom."

GEORGE E. VINCENT

THE MEASUREMENT AND UTILIZATION OF BRAIN POWER IN THE ARMY, II.

Military Applications of Mental Ratings.—The sample distribution curves of Fig. 1 indicate the value of mental ratings for the identification and segregation of different kinds of military material. The illiterate group of this figure was examined by means of Beta, all other groups by means of Alpha.

Comparison of various military groups distinguished from one another by actual attainment in the service shows that the psychological tests discriminate between these groups with definiteness. This point may be illustrated by reference to the percentages of men of different groups making A and B grades in Examination Alpha: officers, 83.0 per cent.; officers' training school candidates, 73.2 per cent.; sergeants, 53.4 per cent.; corporals, 39.7 per cent.; literate privates, 18.8 per cent. The comparison of measures of central tendency reveals equally striking differences. Moreover, within the officer group itself significant differences appear for different branches of the service.

The relation of success or failure in officers' training schools to intelligence ratings is exhibited by Fig. 2, in which it is to be noted that elimination through failure in the school increases rapidly for ratings below C+. Of men rating above C+, 8.65 per cent. were eliminated; of those below C+, 52.27 per cent. The data for this figure were obtained from three schools with a total enrollment of 1,375 men.

Similarly Fig. 3 shows the relation between success or failure in non-commissioned officers' training schools and intelligence ratings. The elimination increases rapidly for grades below C+. Of men rating above C, only 18.49 per cent. were eliminated; of men rating below C, 62.41 per cent. The results presented in this figure were obtained from four schools with a total enrollment of 1,458 men.

Increasingly extensive and effective use has been made of the psychological rating as an aid in the selection of men for officers' training schools, non-commissioned officers' training schools and other lines of training or service which require special ability. It has been convincingly demonstrated that the data of psychological examinations can readily be used to diminish the necessary elimination during training and thus to increase the efficiency of the schools.

The extreme differences in the intellectual status of army groups are fairly indicated by Fig. 4, which presents the data for groups whose military impor-

tance can not readily be overemphasized. Roughly, the groups in the upper half of the figure are important because of their relatively high intelligence and the mental initiative demanded for success, whereas those in the lower half of the figure are important because of poor intelligence and relative inefficiency or uselessness.

These results suggest that if military efficiency alone were to be considered, the army would undoubtedly gain largely by rejecting all D— and E men. This procedure would greatly lessen the group of disciplinary cases so troublesome and costly in the military organization and also the group which in the figure is distributed

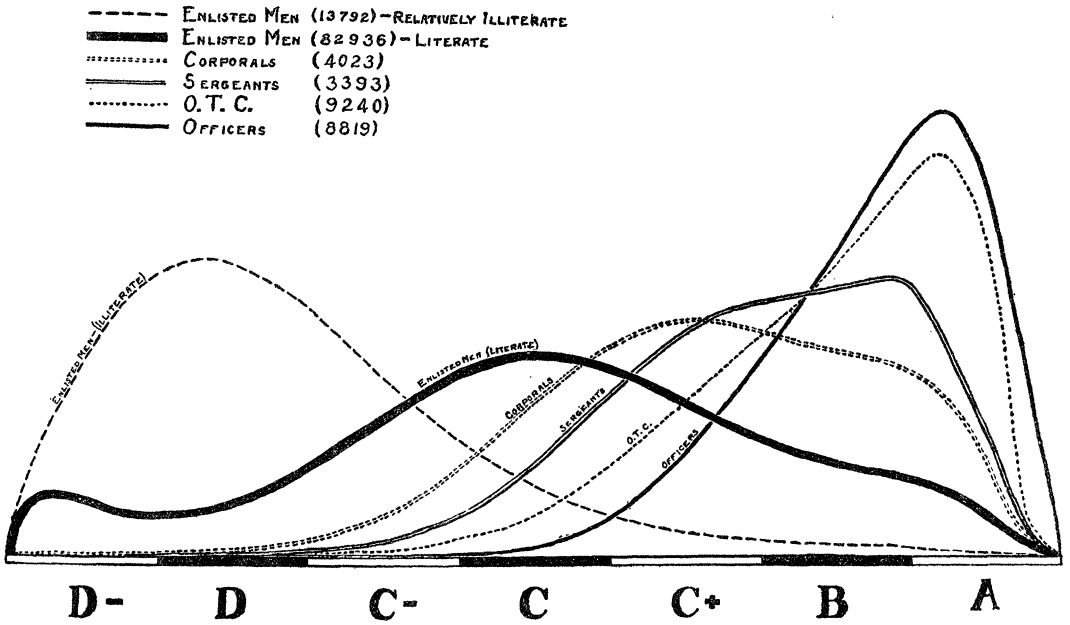

Fig. 1. The distribution of intelligence ratings in typical army groups, showing the value of the tests in the identification of officer material. The illiterate group given Beta; other groups Alpha.

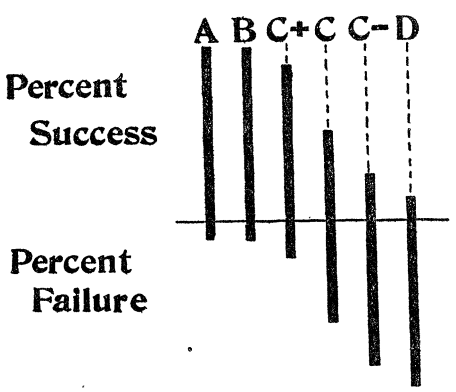

Fig. 2. Success and failure in Officers' Training Schools.

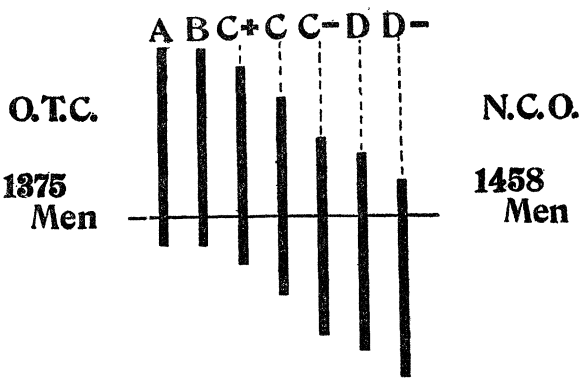

Fig. 3. Success and failure in Non-commissioned Officers' Training Schools.

among "ten poorest privates," "men of low military value" and "unteachable men."

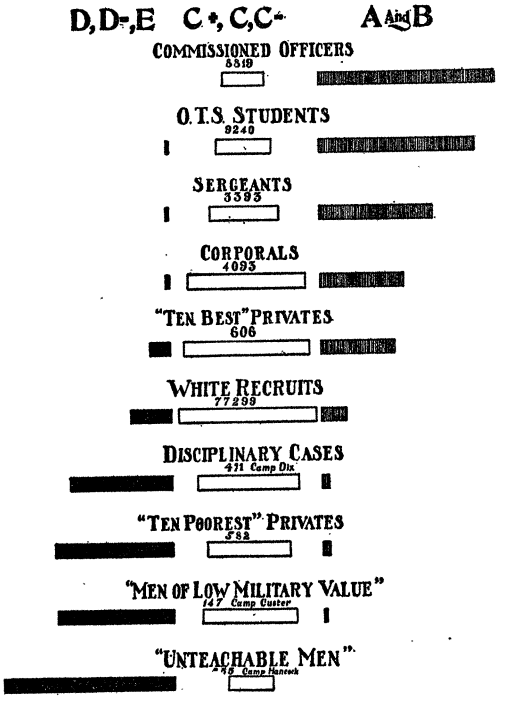

FIG. 4. Proportion of low, average and high grade men in typical groups.

Numerous varieties of evidence indicate the extreme military importance of the prompt recognition of low grade men. The percentages of men ranking below the average in psychological examinations are notably large for the disciplinary group, men having difficulties in drill, men reported as "unteachable" and men designated by their officers as "poorest" from the standpoint of military usefulness.

The comparison of negro with white recruits reveals markedly lower mental ratings for the former. A further significant difference based on geographic classification has been noted in that the northern negroes are mentally much superior to the southern.

The relation between officers' judgments of the value of their men and intelligence ratings is exhibited in somewhat different ways by Figs. 5 to 7. Thus the median scores for five groups of privates arranged in order of military value from "very poor" to "best" are presented in Fig. 5. The total number of individuals in the

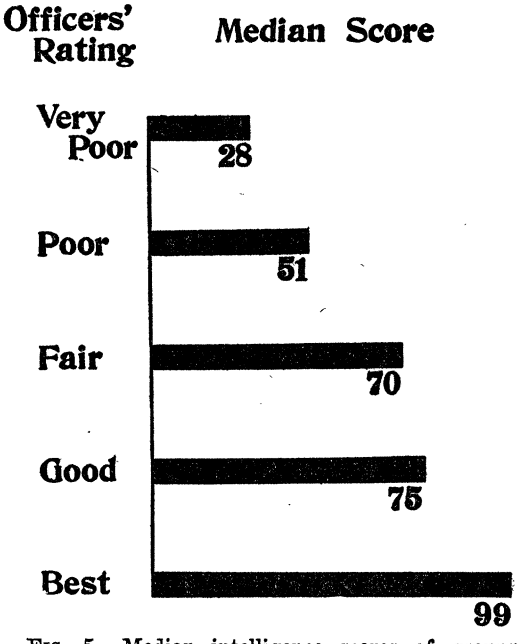

FIG. 5. Median intelligence scores of groups designated as "best," "good," "fair," "poor" and "very poor" in military value.

group is 374. The men were selected from twelve different companies, approximately thirty men in each company being ranked by an officer in serial order from "best" to "poorest." The rank order for each company was then correlated by the psychological examiner with the rank order supplied by psychological examination. In seven of the twelve companies the correlations ranged from .64 to .75. The average correlation was .536. These correlations are high, considering the large number of factors which may influence a man's value to the service.

The median score for the "very poor"

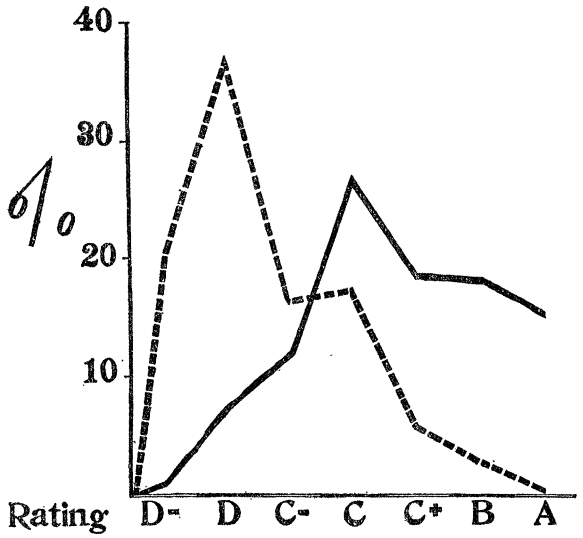

Fig. 6. Intelligence grades of "best" (——) and "poorest" (----) privates. (Best, 606; poorest, 582; total, 1,188.)

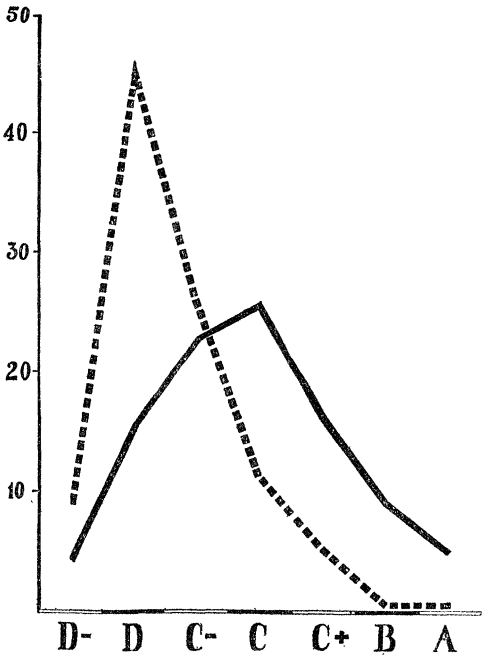

Fig. 7. Men of "low military value" (----) (147), compared with a complete draft quota 12,341, (——).

group of Fig. 5 is 28 points in an examination whose maximal score is 212 points. By contrast with this, the median score of the "best" group of privates is 99 points.

The commanding officers of ten different organizations, representing various arms of the service, in a certain camp were asked to designate (1) the most efficient men in their organizations, (2) the men of average ability and (3) men so inferior that they are "barely able" to perform their duties.

The officers of these organizations had been with their men from six to twelve months and knew them exceptionally well. The total number of men rated was 965, about equally divided among "best," "average," and "poorest." After the officers' ratings had been made, the men were given the usual psychological test. Comparison of test results with officers' ratings showed:

(*a*) That the average score of the "best" group was approximately twice as high as the average score of the "poorest" group.

(*b*) That of men testing below C —, 70 per cent. were classed as "poorest" and only 4.4 per cent. as "best."

(*c*) That of men testing above C +, 15 per cent. were classed as "poorest" and 55.5 per cent. as "best."

(*d*) That the man who tests above C + is about fourteen times as likely to be classed "best" as the man who tests below C —.

(*e*) That the per cent. classed as "best" in the various groups increased steadily from 0 per cent. in D — to 57.7 per cent. in A, while the per cent.

classed as "poorest" decreased steadily from 80 per cent. in D— to 11.5 per cent. in A.

In an infantry regiment of another camp were 765 men (regulars) who had been with their officers for several months. The company commanders were asked to rate these men as 1, 2, 3, 4 or 5 according to "practical soldier value," 1 being highest and 5 lowest. The men were then tested, with the following results:

(*a*) Of 76 men who earned the grade A or B, none was rated "5" and only 9 were rated "3" or "4."

(*b*) Of 238 "D" and "D—"men, only one received the rating "1," and only 7 received a rating of "2."

(*c*) Psychological ratings and ratings of company commanders were identical in 49.5 per cent. of all cases. There was agreement within one step in 88.4 per cent. of cases, and disagreement of more than two steps in only .7 per cent. of cases.

Fig. 6 exhibits a striking contrast in the intelligence status and distribution of "best" and "poorest" privates. The personal judgment data for this figure were obtained from sixty company commanders who were requested to designate their ten "best" and their ten "poorest" privates. Of the "poorest," 57.5 per cent. graded D or D—; less than 3 per cent. graded A or B. The results suggest that intelligence is likely to prove the most important single factor in determining a man's value to the military service.

In one training camp excellent opportunity was offered to compare a group of soldiers selected on the basis of low military value with a complete draft quota. In the "low value" group there were 147 men, in the complete draft quota 12,341 men. The distributions of intelligence ratings for these two military groups appear as Fig. 7, from which it is clear that if all men with intelligence ratings below C— had been eliminated, the "low value" group would have been reduced by at least half.

In a certain training camp 221 inapt soldiers, belonging to a negro regiment of Pioneer Infantry, were referred by their commanding officer for special psychological examination. Nearly one half (109) of these men were found to have mental ages of seven years or less. *The army nevertheless had been attempting to train these men for military service.* In justice to the Psychological Service it should be stated that these negroes had been transferred from camps where there were no psychological examiners. For this reason they had not been examined before being assigned to an organization for regular training.

In another instance some 306 soldiers from organizations about to be sent overseas were designated by their commanding officers as unfit for foreign service. They were referred for psychological examination with the result that 90 per cent. were discovered to be ten years or less in mental age, and 80 per cent. nine years or less.

It has been discovered that when soldiers are assigned to training units without regard to intelligence, extreme inequalities in the mental strength of companies and regiments appear. This fact is strikingly exhibited by Figs. 8 and 9, of which the former shows the proportions of high grade and of illiterate or foreign soldiers in the various companies of an infantry regiment. Compare, for example, the intelligence status of C and E companies. The former happens to have received only 3 per cent. of A and B men along with 38 per cent. of illiterates and foreigners, the latter received by contrast 29 per cent. of high grade men with only 9 per cent. of men who are as a rule difficult to train. It is needless to at-

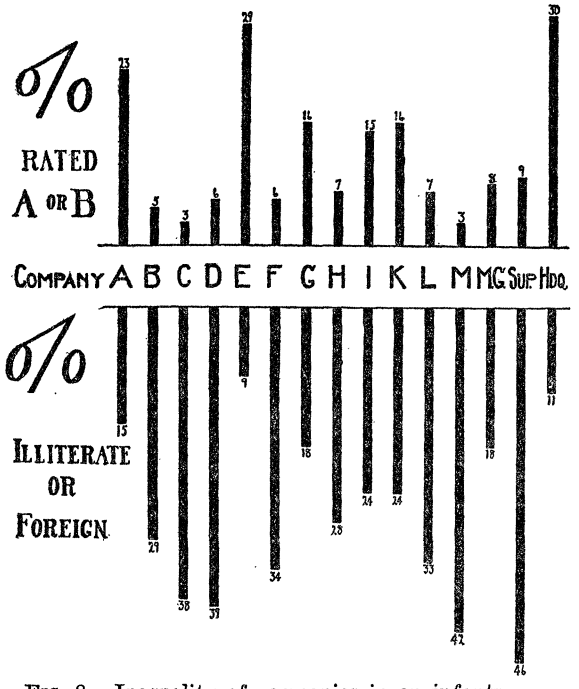

FIG. 8. Inequality of companies in an infantry regiment.

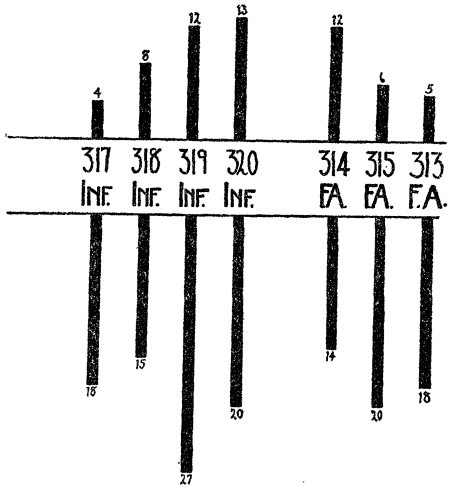

FIG. 9. Inequality of regiments.

tempt to emphasize the military importance of this condition. The tasks of the officers of these two companies are wholly incomparable, but more serious even than the inequalities in response to training are the risks of weak points in the army chain as a result of such random or unintelligent assignment.

Naturally enough the officers of the army were quick to appreciate the disadvantages of a method of assigning recruits which permits such extreme inequalities in mental strength to appear and persist. They promptly demanded the reorganization of improperly constituted units and assignment in accordance with intelligence specifications so that the danger of weak links in the chain and of extreme difference in rapidity of training should be minimized.

That serious inequalities existed in regiments as well as in smaller units prior to assignment on the basis of intelligence is proved by the data of Fig. 9, which pictures the differences found in four infantry regiments and three regiments of field artillery.

Following the demonstration of the value of psychological ratings in connection with assignment, the experiment was tried in various camps of classifying men in accordance with intelligence for facilitation of training. To this end A and B grade men were placed in one training group, C +, C and C — men in another, and D and D — men in a third. The three groups were then instructed and drilled in accordance with their ability to learn. Thus delay in the progress of high grade men was avoided and the low grade soldiers were given special instruction in accordance with their needs and capacity.

The marked differences in the mental strength of groups in different officers' training schools are shown by Fig. 10. For the eighteen schools of this figure, the propor-

tion of A grades varies from 16.6 per cent. to 62.4; the proportion of A and B grades combined, from 48.9 per cent. to 93.6 per cent.; and the proportion of grades below C+, from 0 to 17.9 per cent. Since it is unusual for a man with an intelligence rating below C+ to make a satisfactory record in an officers' training school, it is clear that the pedagogic treatment of these several student groups should differ more or less radically and that elimination must vary through a wide range if the several schools are to graduate equally satisfactory groups of officers.

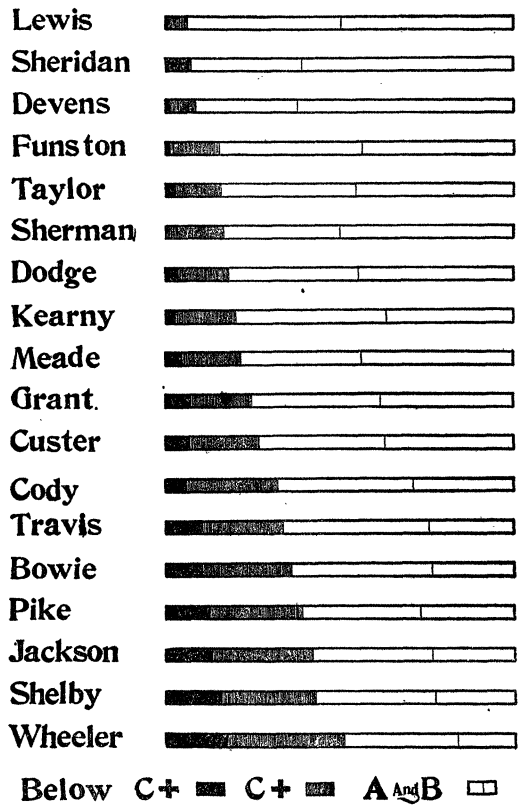

FIG. 10. Inequality of mental strength in eighteen Officers' Training Schools, 4th Series (total enrollment 9,240).

Far more important than the contrast in student officers training groups noted above are the differences in the intelligence status of officers in different arms of the service as revealed by psychological examining. Figure 11 exhibits the data obtained for several groups. The variations are extreme and seemingly unrelated to the requirements of the service. Medical officers, for example,[1]

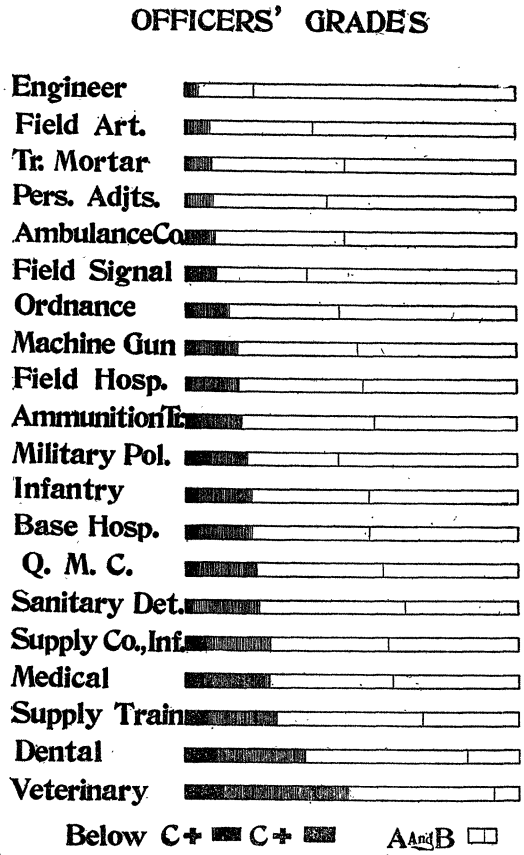

FIG. 11. Proportion of high and low grades in various officer groups.

[1] Medical officers appear in the above graph under five headings: ambulance company (90 cases), fieldhospital (107 cases), base hospital (428 cases), sanitary detachment (50 cases) and "Medical" (378 cases). "Medical" in this case, is chiefly regimental detachments. When all five groups are combined medical officers *in general* take the place in the graph occupied by base hospital.

show a relatively large percentage of men rating C + or below, whereas engineering officers head the list with relatively few men whose intelligence is rated below B. There is no obvious reason for assuming that the military duties of the engineer demand higher intelligence or more mental alertness than do those of the medical officer. Since it is improbable that any arm of the service possesses more intelligence than can be used to advantage, the necessary inference is that certain arms would benefit by the elimination of low grade men and the substitution of officers with better intellectual ability.

Relation of Intelligence to Occupation.—The occupational classification of soldiers in the army afforded opportunity for a study of the relation of intelligence to occupation. Various features of this relation are exhibited for a few military occupations by Fig. 12, in which are represented the proportions of the several grades of intelligence for the several occupations.

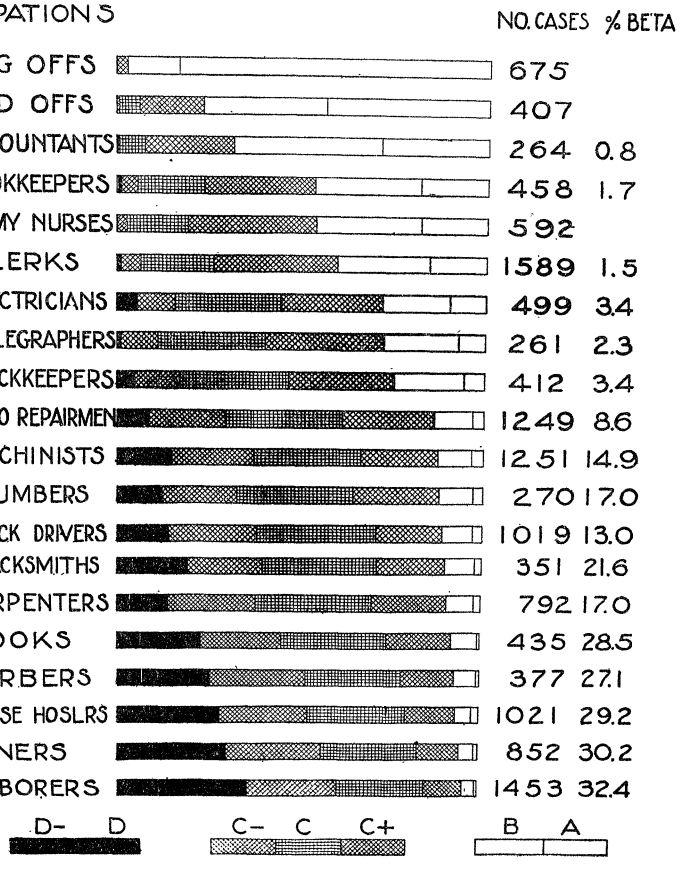

Fig. 12. Relation of occupation to intelligence.

In order of diminishing intelligence exhibited these groups may be classified as follows: professions, clerical occupations, trades, partially skilled labor and unskilled labor. The greatest differences in intelligence required or exhibited appear at the upper end of the scale, whereas the differences within the trades group are relatively small. The differences in range of intelligence occurring in the several occupations

are considerable and in all probability significant. In general the range diminishes from unskilled labor to intellectually difficult professions.

The data of this occupational study, which are merely sampled by Fig. 12, suggest both the possibility and desirability of preparing intelligence specifications for use in connection with civilian occupations. Such specifications, if satisfactorily prepared, should be useful alike as partial basis for educational advice and procedure and subsequently for vocational guidance. It must be emphasized in this connection that the data of Fig. 12 are not strictly comparable with such information as may be gathered concerning civilian groups because various selectional factors operate in the army.

The Applicability of Mental Measurements.—The utilization of methods of mental testing by the army has at once increased military efficiency by the improved utilization of brain power and demonstrated the applicability of the group method of measuring intelligence to educational and industrial needs. The army methods, although not adapted to the usual educational or industrial requirements, can readily be modified or used as a basis for the development of similar procedures.

There are abundant indications that the future will witness the rapid development of varied methods for improving scientific placement and vocational guidance. It is highly probable that grading in the public schools, in colleges and professional schools will shortly be based in part upon measurement of mental ability instead of exclusively on measurements of acquisition. The war has worked a miracle for what may properly be called mental engineering by precipitating expectations, surmises and desires which have long sought expression. Yesterday a few men believed in the probability of the early appearance and practical usefulness of this new branch of engineering; to-day scores of business men, educators and men of other scientific professions are convinced that it has arrived and demand its rapid and effective development.

The complete scientific report on the psychological data which the army has supplied and of which mere glimpses have been given in this article should constitute the basis for further important advances in methods of mental measurement and should greatly add to the knowledge of the distribution of intelligence and its varied and significant relations. These reports are in preparation and it is hoped that they may be published without undue delay.

SCIENTIFIC EVENTS

PROPOSED MAP OF BRAZIL ON THE SCALE OF ONE TO A MILLION

WE learn from the *Geographical Journal* that a further important advance in the mapping of South America is to be expected from the decision of the "Club de Engenharia" of Rio de Janeiro to celebrate the approaching centenary of Brazilian Independence (1922) by the compilation of a map of Brazil which shall also serve as a contribution to the scheme for a general map of the world on the scale of 1/1,000,000. We have received from Senhor Paulo de Frontin, President of the Engineering Club, copies of a memoir printed in 1916 describing the general features of the proposal (the execution of which has, it seems, already been begun) and the methods which it is proposed to adopt. It is pointed out that the great extension of the Republic renders it not feasible to construct a general map, capable of being combined into a whole even as a wall-map, on a larger scale than 1/2M (1:2,000,000), and that on the millionth scale the sheets would necessarily be used separately or combined with neighboring sheets only, Even on half this scale the conjoint map would measure 8 feet by 7½. The original compilation of the new map (the "Mother-map" as it is termed in the United States) will be on the