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Evaluating the Potential of Photo Interpreters

Can motivation, judgment, and logical reasoning be measured by tests and correlated with interpretation performance?

(*Abstract on page 1053*)

INTRODUCTION

IT IS GENERALLY AGREED that candidates to be trained as photo interpretation specialists should possess such attributes as good visual acuity, a sound educational background, imagination, patience, judgment, high perceptual or learning capacity, and proper motivation. Reliable and objective techniques are available for evaluating stereoscopic vision and color perception, but we have been notably slow to devise satisfactory methods for measuring *mental acuity*.

Because the prime objectives of aerial reconnaissance missions may be unattained unless interpreters are adept, mentally alert, and properly motivated, it is obvious that only the most promising candidates should be selected for extensive P.I. training (Sims and Hall, 1956). Predictive screening tests are therefore needed for rating the potential ability of trainees prior to specialized instruction in air intelligence and interpretation techniques.

Regardless of prior education, the candidate who lacks imagination, judgment, and motivation is unlikely to become a top-flight interpreter. There is a vast chasm separating the photo "reader" from the individual who can rationally judge the significance and overall importance of a particular identification. The "reader" may be trained or organizationally developed, whereas the potential abilities of a *bona fide* interpreter must be largely *discovered* instead. The question thus implied is, "How can we separate the wheat from the chaff?"

A research study recently initiated at the University of Georgia is aimed at determining

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* Presented at the Annual Convention of the American Society of Photogrammetry, Washington, D. C., March, 1965. The author is currently serving as chairman of A.S.P. Subcommittee VIII, a study group investigating the training and selection of photo interpretation personnel. Tests and illustrative materials were prepared with the advice and assistance of Professor W. T. Moss, Department of Psychology, and Mr. Dennis M. Richter, Department of Geography, University of Georgia.

(1) whether the elusive qualities of motivation, judgment, imagination, and logical reasoning can be determined by various screening tests, and (2) whether scores on such screening tests can be correlated with interpretation performance at the termination of a specialized P.I. training course. It is therefore apparent that reliable measures of final *performance* must be devised along with the preliminary screening tests.

Screening Tests

Seven types of screening tests have thus far been considered. Three of these are "standard" examinations that may be purchased through various testing bureaus (Zeidner, 1963). The remaining four were devised by the author. In some instances, the specially designed tests employ techniques suggested by Colwell (1961), Sadacca (1963), and Sims and Hall (1956). A brief description of each examination follows.

1. *Object visualization test.*—This test, devised by Miller (1955), consists of 44 drawings; geometric solids are presented as flat or unfolded patterns. Examinees must visualize the geometric shapes that will be formed when the flat patterns are correctly folded or rolled together (Figure 1). Thirty-five minutes are allowed for completion of 44 questions. The test was designed primarily to measure mechanical aptitude, and preliminary results at Georgia indicate that scores are not highly correlated with P.I. ability.

2. *Standard progressive matrices.*—Designed by Raven (1958), this test utilizes 60 figure analogies to measure an individual's capacity for observation, clear thinking, and logical reasoning (Figure 2). The 60 problems are divided into five sets of 12 items, with each set becoming progressively more difficult. The test is not timed, and the examinee's score reputedly provides an indication of his intellectual capacity; thus scores may prove to be related to ratings on mental ability (I.Q.) examinations. The test will be administered to P.I. classes at Georgia during the Winter and Spring quarters of 1965.

3. *Mental ability or I.Q. test.*—The particular test utilized (Otis, 1954) is a group-administered intelligence quotient exam commonly employed by colleges and universities. Students are allowed 30 minutes to answer 80 questions on vocabulary, word relationships, progressions, mathematics, and figure analogies. The average I.Q. of the United States population is approximately 100; the estimated average for students at the University of Georgia is between 110 and 120. For 56 students tested to date in photo interpretation classes, the average I.Q. was 119. On the Otis test, a score of 138 is the maximum possible.

While Sims and Hall (1956) have indicated that an I.Q. of 120 or higher may be desirable for P.I. personnel, it does not appear likely that I.Q. scores and interpretation performance will be highly correlated. A psychologist colleague has opined that persons falling within the "obsessive-compulsive" personality syndrome should prove to be best suited for P.I. training. As a rule, only the more intelligent persons fall in this category, but there are many individuals of high I.Q. whose personality traits are in direct opposition to this description. Thus, while I.Q. is probably an important trait for consideration, it is not expected to be useful as an independent gauge of photo interpretation ability.

4. *Picture integration puzzles.*—This type of test, somewhat resembling a jig-saw puzzle, requires that examinees assemble cut-out portions of an aerial photograph into a composite and complete picture. Scoring is based on the time required to complete the puzzle. The cut-outs illustrated in Figure 3 are

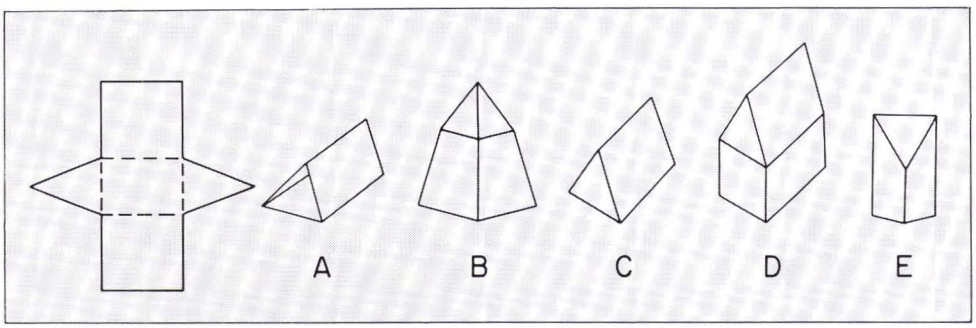


Fig. 1. Sample question from a test on object visualization. When the pattern at the left is folded along the dashed lines, the geometric solid at *C* is formed.

square and uniform in size; however, they may be of varied shapes and sizes for more difficult examinations. The character of photo images and the print scale selected will also affect the difficulty of this type of test. Several different models are currently being considered in the Georgia study.

5. *Identification of simple photo images.*—Twenty-four vertical photo views of commonplace urban and rural features are included in this test designed by the author (Figure 4). The features to be identified are known to all examinees from a ground view; thus the test is an attempt to determine whether such acquired knowledge is utilized in recognizing various "signposts of civilization" from the less familiar overhead view.

Twenty minutes are allowed for recording identifications on a special answer sheet, though most examinees manage to complete the test in 12 to 15 minutes. For 6 of the 24 features shown in Figure 4, identifications are (1) football stadium, (2) soccer field, (3) grain elevators, (4) petroleum storage tanks, (5) steel railroad trestle, and (6) airplanes and runways. Single prints were utilized to facilitate administration of the test to large groups, and because of the difficulty of reproducing high-quality stereograms by halftone printing.

6. *Identification of simulated photo images.*—This test, also designed by the author, requires identification of 39 sketches that depict overhead views or shadows of common urban, rural, or physiographic features.† Forty minutes are suggested for completion, although most examinees tested to date have needed only 25 to 30 minutes. Specific answers are required, but partial credit may be allowed for some identifications (e.g., referring to a river delta as "stream branches," or listing a country club layout as merely a golf course).

With probably one or two exceptions, all sketches represent typical features encountered regularly across the landscape of the United States. In Figure 5, correct identifications are (1-A) deciduous trees or orchards, (1-B) coniferous tree plantation, (2) military post, (3-A) twin peaks, with a mountain road passing between, and (3-B) mine, pothole, or depression with a small lake. It is interesting to note that the military post has proven the most difficult of the 39 identifications, while a football field and a basketball court have been recognized by nearly 100 per cent of examinees tested.

7. *Visual search tests.*—Sometimes called spatial orientation or grid location tests, these examinations require students to determine the exact positions of small photo cut-outs on a larger print of the same area (Figure 6). Cut-outs may or may not be at the same scale as the larger picture. Examinees are rated according to the time required to list the correct grid coordinates of the photo cut-outs.

Variations of this test include comparisons of oblique to vertical views, matching map locations with photographic images, and vice versa. Inasmuch as such exams are primarily designed to measure visual search ability they may prove more valuable for rating final P.I. performance than as pre-training or screening tests.

† Copies of tests and answer forms described in Figures 4 and 5 may be purchased by addressing the Printing Department, University of Georgia, Athens.

ABSTRACT: *If it is possible to predict the* potential *ability of persons to be trained as aerial photo interpreters* in advance *of extensive P.I. training, agencies responsible for the selection and training of military interpreters and air intelligence specialists might effect considerable savings in time and money. At the University of Georgia, a series of tests is currently being devised to determine whether or not there are personal attributes (in addition to good visual perception and a minimum educational background) relating to P.I. ability which can be measured prior to specialized interpretation training. Some tests employ actual photographs or "simulated photo images"; others span a range from mechanical aptitude and spatial orientation exams to standard I.Q. and psychological tests. Work is being conducted with the cooperation of the School of Forestry, Department of Geography, and Department of Psychology.*

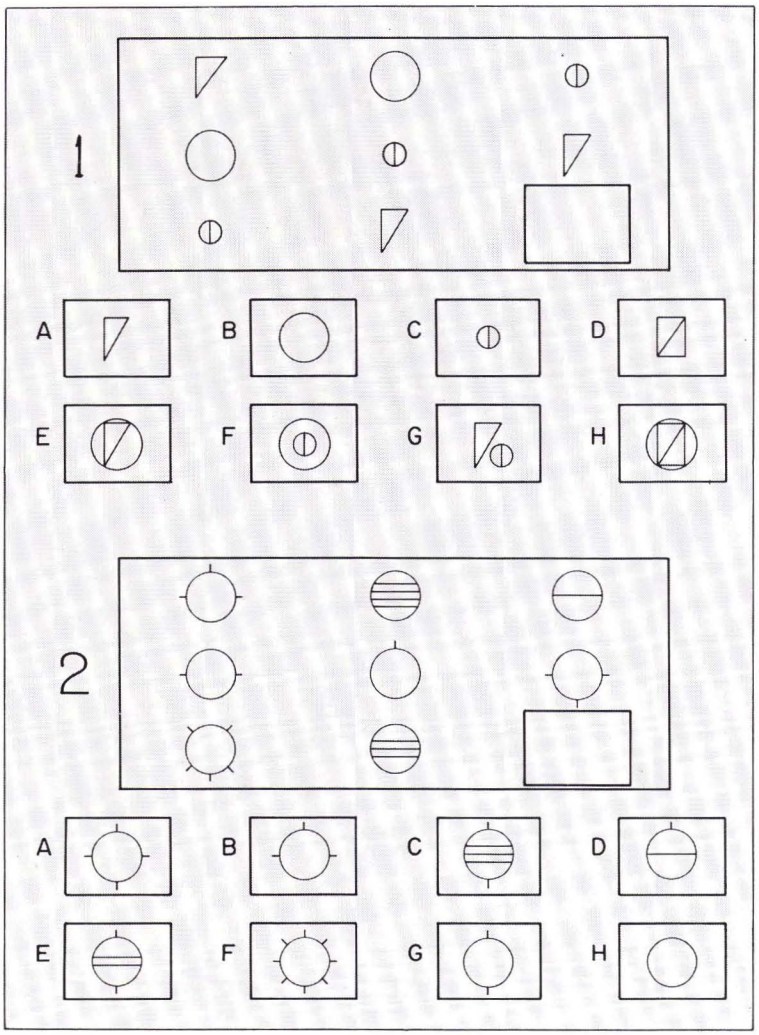


FIG. 2. Two types of questions from a progressive matrix or figure analogy test. In question 1 (easy), the correct answer is "B." For question 2 (difficult), *G* is the proper selection. The logic behind these choices is left to the reader's powers of deductive reasoning.

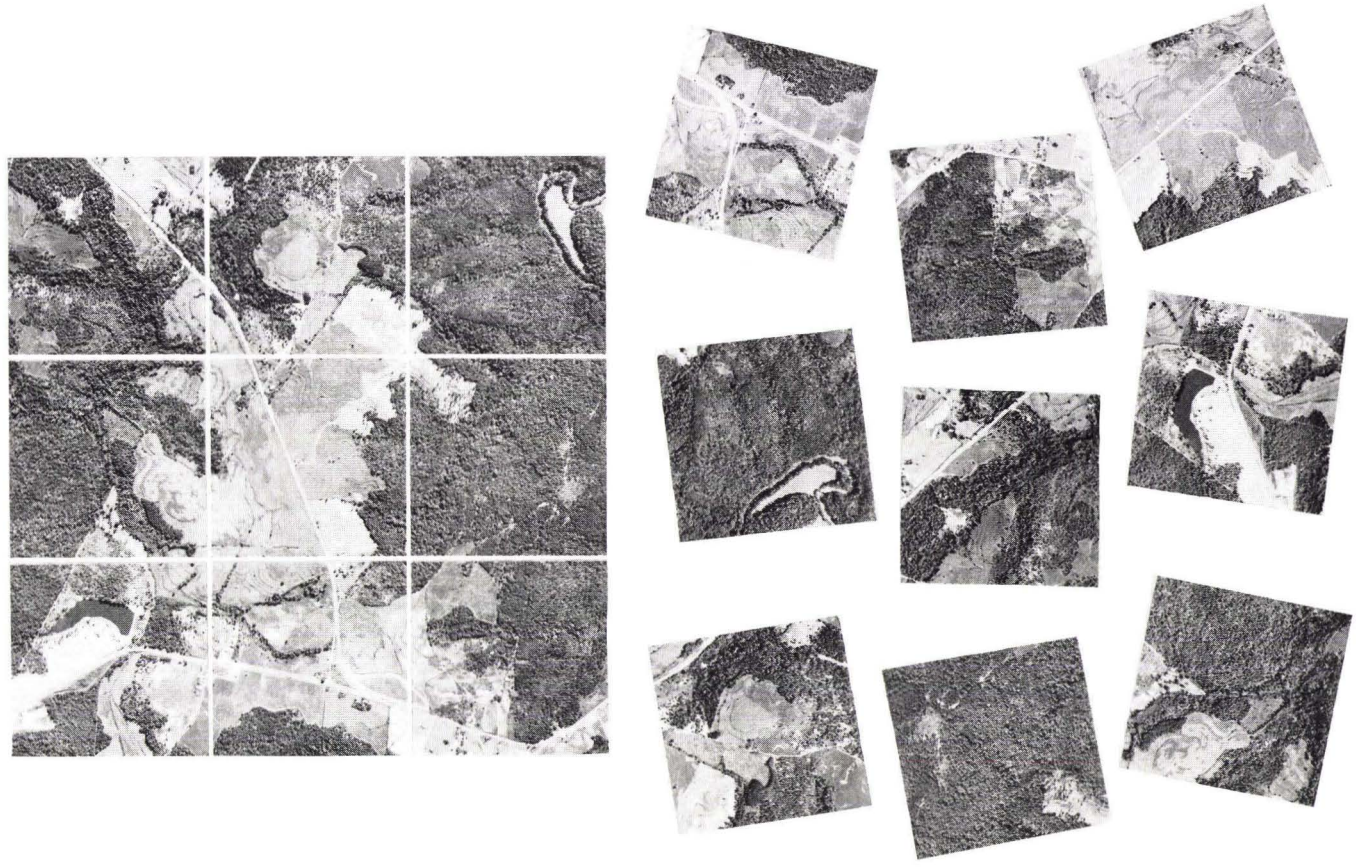


FIG. 3. Example of a picture integration or puzzle test devised by the author. Interpreters are rated according to the time required for arranging the nine jumbled squares into a composite photograph.

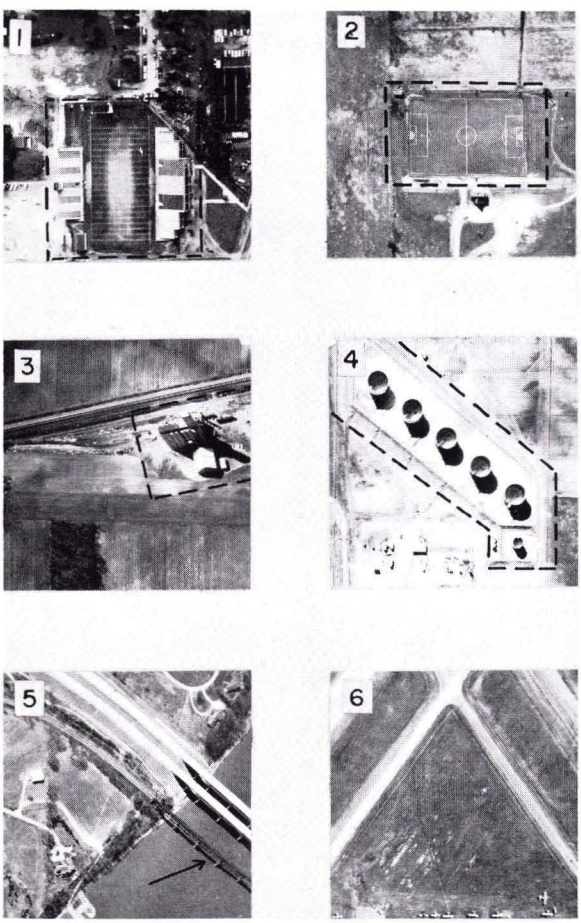


FIG. 4. Portion of an aerial photo identification test designed by the author. Photo scales range from 330 to 660 feet per inch. See text for correct identifications.

Preliminary Test Results

The true value of screening tests described here cannot be ascertained until scores on each can be compared with final P.I. performance for a large number of individuals. If results from one or more of the "standard" examinations (e.g., figure analogies) are highly correlated with performance, it would appear desirable to give such tests preference over those employing aerial photographic images. The "standard" examinations are readily obtained from testing bureaus, they have been statistically evaluated for varied groups of individuals, and norms are usually available for standardized group comparisons.

Final P.I. performance tests are still being developed in the Georgia study, so comparative scores are presently limited to the various screening tests. Four of the seven tests (Numbers 1, 3, 5, and 6) were administered to 56 college students in January, 1965. As the screening tests employing photo images (No. 5) and simulated images (No. 6) are similar in nature to certain performance tests, percentage scores from these two exams were combined for each individual and graphically compared to Otis I.Q. scores. Results are illustrated in Figure 7. It will be noted that there is a negligible degree of correlation between the plotted variables. Thus, if screening Tests 5 and 6 subsequently prove to be valuable as predictors of P.I. performance, then I.Q. scores are unlikely to have an equally important role in the screening process.

A scatter diagram similar to that shown in Figure 7 was obtained when results of Test 1 (object visualization) were plotted against the combined P.I. scores in lieu of Otis I.Q. scores. Again, the lack of high correlation indicates that each of the screening tests described is likely to assume a different degree of importance in predicting final P.I. performance. Just *which scores* will prove most valuable is open to speculation at this time.

Figure 8 presents the graphical relationship between scores on screening Test 6 (simulated images) and Test 5 (photo images) for the same 56 students represented in Figure 7. The close relationship between these paired scores appears to imply that both tests are measuring the same type of interpretation ability. Accordingly, if Tests 5 and 6 later prove to be good indicators of P.I. performance, then it seems likely that only *one* of them will be required in a battery of screening examinations.

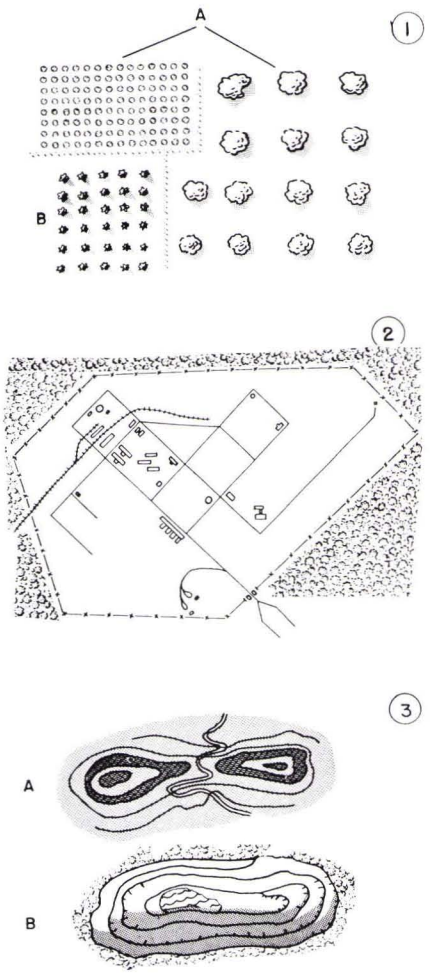


Fig. 5. Portion of a simulated photographic images test designed by the author. Sketches represent overhead views or shadow patterns of physical and cultural features. See text for correct identifications.

Final Performance Tests

Compilation of final photo interpretation performance tests is now underway. While the exact composition of such examinations has not yet been established, the following test categories are likely to be given priority:

1. Visual search tests (spatial orientation)
   - A. Vertical to vertical photos
   - B. Oblique to vertical photos
   - C. Photo to map locations
   - D. Map to photo locations
2. Identification of complex photo images
   - A. With P.I. keys
   - B. Without P.I. keys
3. Interpretation judgment and estimating
   - A. Judging the significance or importance of features

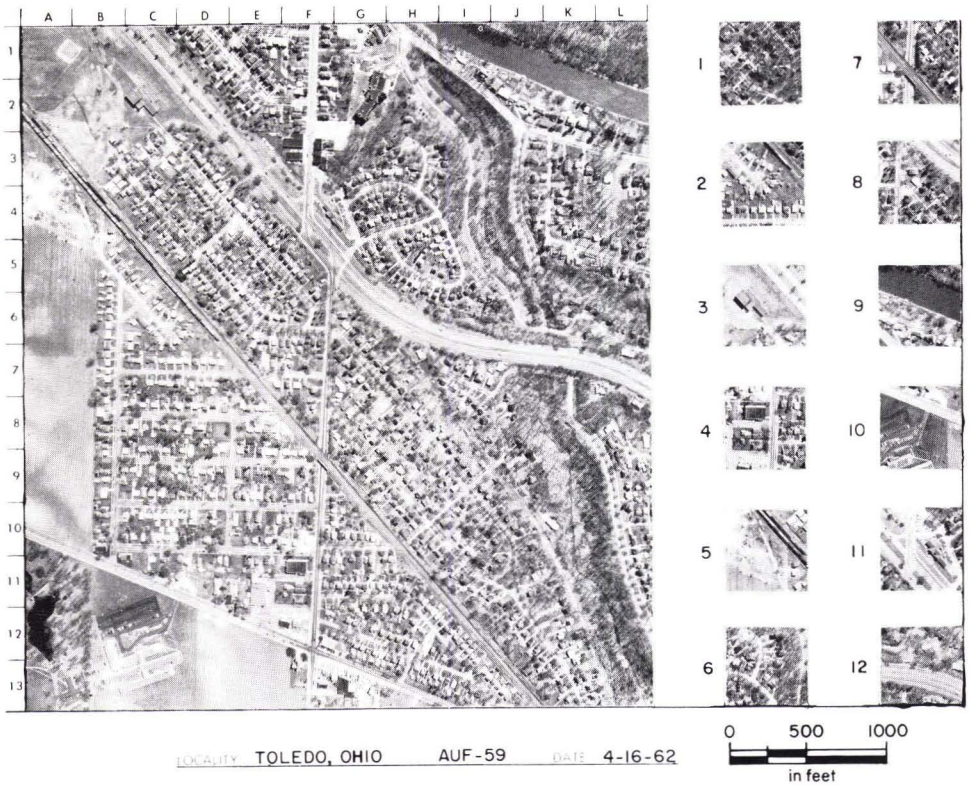
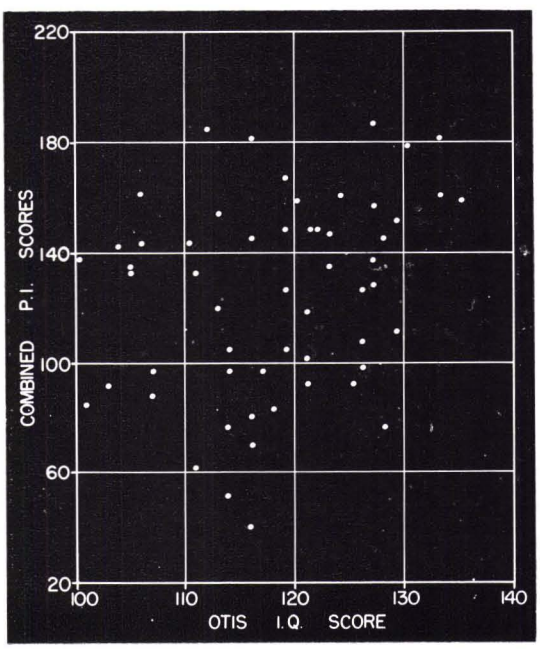


FIG. 6. Example of a visual search or spatial orientation test designed by the author. Examinees are graded on the length of time required to locate the grid coordinates of the small photo cut-outs on the large print. Photograph courtesy of Abrams Aerial Survey Corporation.



B. Quantities, sizes, distances, heights, and areas

4. Scholastic record or composite "course grade."

Item 1 includes variations of visual search tests described in Section 7 on screening examinations. Photo identification tests (Item 2) will presumably include recognitions that require deductive processes and reasoning rather than merely identification by rote or memory. Category 3 will encompass both evaluations of an interpreter's judgment as well as his ability in making a variety of quantitative or mensurational determinations. The use of a composite "course grade"

FIG. 7. Graphical comparison of combined scores on two P.I. screening tests with I.Q. scores for 56 college students.

as suggested in Item 4 will probably be considered as a last resort, because such grades often include factors not directly related to actual P.I. performance.

Project Plans

Under present plans, it is anticipated that this testing project may require continuation for a period of two to four years before wholly reliable screening and performance exams can be developed and evaluated. If necessary funds can be obtained, the scope will be enlarged to allow testing of individuals in other universities and perhaps trainees in P.I. classes at some military posts or air intelligence schools. Comments and suggestions from interested Society members will be welcomed.

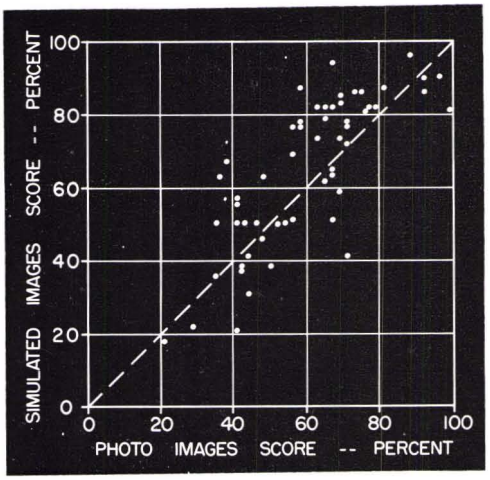


FIG. 8. Relationship between scores on a simulated images test (Figure 5) and a simple photo identification test (Figure 4) for 56 college students.

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