CHAPTER IV

Measurement of Aptitudes in Specific Fields[1]

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IN THIS DISCUSSION the word "aptitude" is used in two ways—one as a measure of a special ability (for example, the measurement of visual acuity), and the other as a prognostic measure (for example, the use of a special test to forecast success in an occupation). The chapter will not cover all measures of these types since educational tests are dealt with in other issues of the REVIEW and another chapter of this issue covers certain applications of intelligence tests.

General Treatises of Vocational Aptitude

O'Rourke summarized the literature on vocational aptitudes from 1935 to 1937 in the June 1938 issue of the REVIEW (88). Since that time several general evaluations and discussions have appeared. Most important was the one by Stead and others (109) which discussed research methods in occupational prognosis and gave results in the testing of aptitude for several specific occupations. The study described the technical activities of the Work Analysis Section of the U. S. Employment Service, which developed measures of proficiency for people already in occupations. Oral trade questions in 126 occupations have been developed.

One limitation in the use of the results of these studies is that the tests have been ratified for specific occupations rather than for individuals seeking guidance, and the test batteries are therefore employment tests rather than general guidance tests. An employment test is one given by a prospective employer to see if a specific applicant has the requisite ability. A guidance test is a test which will help the individual determine what type of occupation he is best fitted to enter. An inspection test of the type described by C. A. Drake (26) is a good prognostic test for inspectors of metal piecework but it has no known value as a guidance test. A mechanical aptitude test on the other hand has some guidance value but is not a specific employment test. Some tests may be useful for both purposes; for example, a manual dexterity test is both a guidance test and a specific employment test. Many of the tests described in the volume by Stead and others may have guidance value, but until they are tried out in a more general situation their guidance value is not known. A second limitation to this study is that the persons taking the tests were already in the occupations when tested, and some of the traits which they possessed may have been obtained on the job. Not until it can be shown that the traits are needed by *beginning* workers can the presence or absence of the trait be used as a good guide for employment.

[1] Bibliography for this chapter begins on page 52.

The interpretation of validity coefficients for guidance measures was discussed by Taylor and Russell (114). They pointed out that the validity of a score for prognosis will vary with the critical score and the percent of persons usually successful on entering an occupation. Bell (6) reviewed the relationship between adjustment scores in college and occupational intentions, while Bingham (10) pointed out the need for the accumulation of research data over a period of years for good prognosis but cautioned against believing that interests and abilities are constant. General expositions of the use of measures for determining special aptitudes as well as more general aptitudes are those by Ruch and Segel (95), and Paterson, Schneidler, and Williamson (90).

Aptitude for Specific Academic Fields

The elementary field will be omitted because at that level, except for specialized tests for beginning school children, the best aptitude indicators are the achievements in the individual fields.

Several investigations of the aptitude for algebra (15, 62, 79, 99) compared the value of general intelligence, arithmetic achievement, reading achievement, and the following special aptitude tests: Iowa Aptitude Test for Mathematics, Orleans Aptitude Test for Algebra, and the Lee Test of Algebraic Ability. The conclusion reached was that the special aptitude tests are best, the arithmetic tests next best, closely followed by the intelligence tests. The other measures are distinctly less favorable as algebraic predictors. The results of these studies confirmed previous work.

Traxler (117) and Segel and Proffitt (103) made extensive investigations to establish that marks in different subjects in high school and college have differential and direct predictive value which is substantial. Stuit and Donnelly (112) found that for a differential prognosis of success for most of the academic subject groups in college, the following tests could be used: Iowa High School Content Examination, the Iowa Mathematics Aptitude and Training Tests, and the Iowa Silent Reading Tests. These results also are in accord with previous studies. Working with the College Board Scholastic Test, Dickter (21) found the mathematical parts much more predictive of college success in mathematics than was the verbal part. Greene (48) analyzed the prognostic value of mental tests, vocabulary tests, interests, and previous training for 458 students in a psychology course. He found that by using several factors a fairly satisfactory prognostic value could be obtained.

The Detroit General Aptitudes Examination (3) was developed for the first two years of high school to differentiate between aptitudes for general academic work, industrial arts, and various manual trade subjects and clerical course subjects. The materials of this test consist of motor performance, mechanical information, visual imagery, verbalization, and achievement in arithmetic, reading, spelling, and handwriting.

Interest indicators afford an indirect means of indexing aptitude for various academic subjects. Research on the relationship of interest scores to specific school courses has been mainly a development of the period here reviewed. The Michigan Vocabulary Profile Test (47) gives an indirect indication of interest in the following different types of school courses: human relations, commerce, government, physical sciences, biographical sciences, mathematics, fine arts, and sports. A study (49) of the profiles on this test for students who had chosen distinct occupational courses showed that the test distinguished between graduate nurses, engineering students, and first-year medical students, but not between business administration seniors and graduate students in education.

The Vocational Inventory developed by Gentry (45) covered vocational areas and used information rather than vocabulary. The areas covered are: social service, literary pursuits, law and government, business, artistic pursuits, mechanical designing, mechanical construction, and scientific pursuits. The value of the inventory in determining aptitude for college courses was supported by Gentry. Another measure of interest constructed by Kuder (63) can be used for both educational and vocational guidance. Its categories of interests are: scientific, computational, musical, artistic, literary, social service, persuasive. The items were made up from activities in which students might conceivably sometime engage, and are direct interest items instead of informational. The Dunlap Preference Blank was studied by Sharkey and Dunlap (106). It was found valid as an indicator of success in several different school subjects. Congdon (16) found that the Cleeton Vocational Interest Inventory was of value in differentiating between students of education and others. Duffy and Crissy (32) made a study of the relation of the evaluative attitudes—economic, political, theoretical, esthetic, social, and religious—to vocational interests and found significant trends between the two.

Musical Ability

The Seashore Tests of Music have been revised (101). Included as before are pitch, loudness, time, rhythm, and tonal memory, but a new test of timbre replaces the old consonance test. Semeonoff (104) experimented with the measurement of the appreciation of music through having students listen to ten phonograph records and select the best interpretation out of four alternates. The reliability of the tests was found to be high. Another method of appraisal of musical aptitude at the high-school level was developed in the high school of the University of California (70). Ten each of the following were used: rhythmic patterns, melodic patterns, dissonant and consonant chords, and differentiation in pitch and intensity.

Seashore (100) discussed musical theories and (102) outlined the rules for the construction of a sight singing scale. Tests of ability to sing simple

phrases were found to be more discriminative at preschool ages and reflected progress better than singing single notes or two-note intervals, according to a study made by Updegraff, Heiliger, and Learned (119). Murrell's criticism of the validity of music tests (82) has in turn been attacked by Kwalwasser (64). A study of the changes in harmonic sensitivity in children over a period of years by Farnsworth (38) showed that with increasing musical sophistication there was a tendency to brand fewer and fewer musical combinations as bad.

Several analyses of the scores on musical tests by themselves and in conjunction with scores on other tests have been made in order to find the fundamental musical traits. R. M. Drake (29, 30) made factorial analyses of the scores on the Test of Musical Memory and Retentivity, Kwalwasser's Test of Tonal Memory, and Seashore's measures of pitch, rhythm, intensity, time, and tonal memory. More than one common factor was found. It was suggested that the major one was "memory for auditory items." The five Seashore tests were not found to satisfy the criterion of division into independent measurements of isolated capacities. The relation between the intelligence test scores and scores on certain of the Drake Music Tests, the Seashore battery, the Lowery measure of cadence, and the Kwalwasser-Dykema Tests of Melodic Taste and Tonal Movement was found to be low by R. M. Drake (31). Morrow (80) found that scores obtained on tests of musical, artistic, and mechanical abilities did not show clear differentiations between the three fields. Kwalwasser (65) concluded that the correlation between intelligence and musical ability is low because of the regression effect. Larson (67) found a correlation of .59 between Seashore scores made in high school and later marks in a music school.

Art Aptitude

Varnum (121) developed an art aptitude test having exercises on color memory, tone graduations, proportioning, static balance, rhythmic balance, feeling for geometric form, and creative imagination. The subsections correlated from —.15 to +.31 with each other and from .18 to .62 with the total score; the reliability of the total test ran as high as .88 on one group. The test was validated through scores made by art students and persons in related occupations. This test is one of the most important aptitude tests developed recently. The McAdory Art Test was revised for use with such racial groups as the American Indian by Steggerda and Macomber (110). It failed in this purpose because the racial group tested (the American Indian) based its judgment on the utilitarian rather than the artistic characteristics of the objects and situations pictured. The reliability of the Knauber Art Test was questioned originally, but Moore (78) found a reliability of .90 for it in a group of 158 college students and art teachers. Burt's picture test for artistic appreciation was found by Dewar (20) to have the highest reliability and validity among several art tests.

Several studies were made dealing with the search for independent art traits. The most important of these is probably the over-all study and review made by Meier (72). He came to the conclusion that artistic aptitude rests upon the possession of six factors: manual skill or craftsman ability, energy output and perseverance in its discharge, general and esthetic intelligence, perceptual facility, creative imagination, and esthetic judgment. Other studies made in this area are those by Eysenck (37) who found some evidence for a general factor of visual esthetic appreciation; and Dewar (20) who made a factor analysis of Burt's picture test for artistic appreciation and found indications of a general artistic aptitude and suggestions of specifics. Lark-Horovitz (66) worked on the type of pictures preferred by boys and girls at different ages, while Miller (74) tried out intelligence, personality, and other measures on art students at the high-school level and found none of them to be related to dramatic ability.

Visual Acuity and Auditory Testing

The controversy over the best methods of testing the sense of sight has continued. The interpretation of the research results is complicated by certain factors, one being that eye deficiency (so-called) is not always a liability. For example, myopia proves advantageous to persons doing certain kinds of work and possibly in facilitating reading. Studies of the relation of vision to efficiency in various school, occupational, and recreational activities will no doubt reveal factors which will eventually differentiate among the procedures in testing vision in accordance with the objectives in view.

Eames (34) found that his test of acuity of vision was reliable and valid. His test was 95 percent correct when judged by an oculist's findings. Norms for various groups of students from kindergarten to college have been gathered by Betts (8) in the three efficiency slides designed for use in the Betts Telebinocular series. He reported many investigations of the use of the Betts Binocular Tests for vision in general and for specific purposes at varying age and grade levels. Hildreth and Axelson (53) adapted the Snellen E chart so as to make the testing a game for young children. At the college level, Frazer, Ogden, and Robinson (43) found that the Betts Tests of Binocular Skill were not reliable enough for diagnostic work. Molish and Reese (76) gave the Betts Test of visual efficiency and sharpness of image to 69 college students and then tested them in an optometric clinic. In several cases those failing to pass the Betts tests showed acuity of 20/20 on the Snellen test letters, while others who passed showed less than 20/20.

On the elementary-school level, Oak and Sloane (85) concluded from using the Betts Visual Sensation and Perception Tests and checking with an ophthalmologist that the Betts tests sorted out far too many children for ocular attention while at the same time they missed some children needing attention.

Oak (84) compared one hundred pupils less than sixteen years old, handicapped in reading, with one hundred pupils of the same age, showing no handicap in reading, on the results of testing with the Betts cards (D B Series) and on examinations made by an ophthalmologist. He concluded from his findings that the Betts cards do not serve to screen out children who should be referred to an eye specialist. English and others (35) tested 485 third-grade children with the Betts telebinocular method and the method described in the report of the joint committee of the N.E.A. and A.M.A. (83). The results indicated that the latter method was superior to the former. The higher error in the Betts method was attributed to failure to detect myopics. The relation of the measures obtained from the Betts Tests of Visual Sensation and Perception and Ives Test of Acuity and Ametropia to reading speed for students at the college level was found by Stromberg (111) to be insignificant. The work of Hitz (55) and Schwartz (97) also indicated the inadequacies of the present instruments to deal adequately with the testing of vision in the schools. The special testing of the change or adjustment of sight for changes of intensity of light and ability to change from looking at near objects to distant objects and vice versa, such as is required of airplane pilots, has been described by Ferree and Rand (39, 40).

A comparison of tests of color blindness was made by Philip (91). He found correlations of from .50 to .90 with 42 cases of defective color vision between the following tests: Ishihara, Edridge-Green, Nagel, Holmgren wools, Philip color perception, and the new edition of the Ishihara. The Ishihara and the Philip tests had certain advantages. Philip (92) also established that errors in distinguishing colors were made more frequently by boys and men than by girls and women.

Hearing—The efficiency of most of the several types of hearing tests in current use was tested and discussed by Holmgren (57) while Silverman (107) investigated thoroughly the 4-A and 2-A individual audiometer. The 4-A audiometer was found inadequate in that all the elements of English speech were not included and the 2-A individual audiometer was inadequate because it was not calibrated finely enough to insure a complete picture of the child's hearing loss. An analysis of the World's Fair hearing tests by Montgomery (77) verified the general findings of hearing in regard to age and sex.

Mechanical and Manual Dexterity Tests

In this section is included a discussion of studies of manual, motor, and physical aptitude, as well as those of mechanical aptitude. It is hoped that a new and better classification of these different traits will soon be attempted. As mental and physical traits are more clearly defined the tests will tend to fall into correct categories.

Packard (89) found that mechanical aptitude in pupils of high-school age could be measured best by a combination of (a) intelligence, (b) aca-

demic achievement, (c) grade level, (d) mechanical ingenuity, (e) coordination, (f) manipulation, (g) spatial perception, and (h) construction. A different approach to the same problem was offered by Harrell (51) who made a factorial analysis of mechanical ability tests including the Minnesota battery of mechanical tests, the MacQuarrie Test of Mechanical Ability, the O'Connor Wiggly Blocks, and the Stenquist picture-matching test. He found five factors present—perceptual, verbal, youth, manual agility, and spatial. More evidence as to the multi-trait nature of mechanical aptitude was presented by Slater (108) who found that valid tests of this aptitude were saturated with spatial relationships. Hayes and Drake (52) found no relation between results of the MacCauley Tetrahedron Test and ability in descriptive geometry.

The motor performance of 80 girls and 85 boys was followed over a period of years by Espenschade (36). Correlations between motor performances and all measures of physical growth and maturity were low for girls but the reverse was true for the boys. Intercorrelations among motor performances were all positive but varied in magnitude. O'Connor (86, 87) gathered further norms on his Block Cube and Finger and Tweezer Dexterity Tests. Van Der Lugt (120) developed a series of tests for the study of motor functions consisting of speed of performance in (a) threading of beads, (b) punching holes in a sheet of paper, (c) pressure sense, (d) precision, and (e) motor memory. Other studies in which norms were developed for achievement scales in physical activities were those by Metheny (73), McCaskill and Wellman (69), Powell and Howe (93), Glassow, Colvin, and Schwarz (46), and by several Wellesley graduate students (115). The distribution of hand usage dextrality was further developed during this period by W. Johnson and others (60, 61).

Manual Semi-Skilled and Skilled Trades

C. A. Drake and Oleen (28) believed it possible to select with high efficiency employees for factory type work. Evidence confirming C. A. Drake and Oleen's optimistic analysis is found in a study by Hiscock (54) in England; testing situations like the actual work were used to select workers. Similar results were found in Sweden by Anderberg and Westerlund (2) who constructed a miniature weaving machine for use in securing a measure of textile learning rate. C. A. Drake (26) used a twisted rod inspection test, a pin board test, and a paper and pencil design test with success in the selection of inspectors of factory work. Tiffin and Greenly (116), however, found that the Keystone Visual Safety Tests, a hand movement test, and the O'Connor Finger Dexterity Test had little validity individually in testing aptitude for simple manual factory operations. A combination of the three produced a validity coefficient of .60. A maze test was found useful in discovering aptitude to follow electric wiring patterns (94).

The foregoing tests are known as employment tests since they are directly related to a particular job. In an attempt to find tests which might be useful in the discovery of persons with an aptitude for larger areas of skill, Slater (108) and Holliday (56) found that ability in various space and form relationship tests was basic to aptitude in the mechanical trades. They found no evidence, however, of a special mechanical aptitude such as is given by scores on "mechanical aptitude tests." They concluded that "mechanical aptitude tests" measure to some extent spatial relations and also general intelligence.

Clerical Aptitudes

The new Turse Shorthand Aptitude Test (118) was constructed from tests of manual dexterity, spelling, phonetic association, symbol transcription, word discrimination, dictation, and word sense. Hales (50) gave the Minnesota Vocational Test for Clerical Workers and Thurstone Examination for Clerical Workers to 129 inmates of a Minnesota reformatory for men who were studying clerical subjects or doing clerical work. The correlations of the test results with the supervisors' ratings were low—averaging about .35. Davidson (18) made an evaluation of the following clerical tests: Bureau Test VI, Thurstone Clerical Test, a modification of the Thurstone Clerical Test, Minnesota Vocational Test for Clerical Workers, O'Rourke Clerical Aptitude Test—Junior Grade, O'Rourke Clerical Aptitude Test—Senior Grade. He compared the results of the tests with supervisors' estimates and with promotability as indicated by the level of job attained at the end of a given period of employment. The validity coefficients, in terms of supervisors' ratings, ranged from .27 to .44. The validity coefficients, in terms of promotability, ranged from .07 on the number checking part of the Minnesota test to .77 on the O'Rourke Clerical Aptitude Test—Senior Grade. This kind of validity is limited by the fact that the testing was done on persons already working in the clerical field. The high standing of the O'Rourke Clerical Aptitude Test can more easily be attributed to the training received on the job than to inherent aptitude. Stead and others (109) reported fifty-one validity correlations for tests in a number of clerical occupations. The criterion of success in most cases was a direct production record rather than supervisors' ratings. The coefficients ranged from .35 to .68, two-thirds of them being below .50. The limitation of the method involved in deriving these validity coefficients is the same as for those quoted for Davidson.

Professional and Semi-Professional Pursuits

Dwyer (33) made an analysis of 19 occupational scorings of the Strong Vocational Interest Test given to 418 students entering medical school and found that the scores yielded for four "key" occupations—physicist, journ-

alist, minister, and life insurance salesman—explained most of the scores on the 19 original occupations. Regression equations using the scores for these four "key" occupations predicted scores for most occupations with multiple correlations of .80 or better. A study of the variation in types of ability in relation to the type of institutions was made by Bryan and Perl (14). They tested women students in the Pratt Institute (an art school), the Institute of Musical Arts (a school of music), and New College of Columbia (an undergraduate school of education), with the Bernreuter Personality Inventory scored for neurotic tendencies, a test of rote memory, a motor speed test, and the American Council Psychological Examination. The students in the three different colleges were significantly different in some of the traits.

Dentistry—A battery of 34 items used for selecting dental students was described by Bellows (7).

Education—Successful educators were found to be superior in intelligence by Shannon (105). However, Shannon studied administrators and supervisors with teachers, and judged success by promotability which is perhaps more of a measure of executive ability. Barr (4, 5) and Mathews (71) analyzed the relation of teachers' scores on a large number of tests to changes in achievement in their pupils. None of the measures proved very significant. The two found to be of most value were the American Council Psychological Examination and Yeager's Scale for Measuring Attitudes toward Teachers and the Teaching Profession. These studies like many others on the adult and college level suffer from attempting to interpret ability on the job as aptitude for the job.

Engineering—Laycock and Hutcheon (68) gave 144 students of the freshman engineering class a number of tests during their freshman year. The results were correlated with the average grades obtained during that year. The following correlations were obtained: American Council on Education Psychological Examination, .34; last-year high-school grades, .61; Cox mechanical aptitude test (models), .16; a paper formboard test, .25; physical science interest (Thurstone), .26. By careful selection of these tests a multiple correlation of .66 with the criterion was obtained.

Medicine—Most of the studies (12, 22, 24, 81) carried on with the Moss Medical Aptitude gave results supporting the view that it is superior to any other methods in the selection of medical students. Marks in premedical education, however, have also been found of value.

Nursing—Williamson, Stover, and Fiss (123) determined that a comprehensive testing program consisting of (a) a college aptitude test (vocabulary), (b) the Moss Nursing Aptitude Test, (c) the Cooperative English Test (usage and spelling), and (d) a Cooperative General Science Test, was a fairly valid measure of aptitude for nursing. Williamson also made some pertinent observations regarding the effect of varying marking and rating systems in different nursing training schools upon the validity of coefficients. Garrison (44) studied the relation of the scores on the Bern-

reuter Personality Inventory to ratings on student nursing practice. He also used the Otis Intelligence Test, the Detroit Mechanical Aptitude Test for Girls, and the Iowa Reading Test. Correlations of these measures with nursing practice ratings were .59, .37, and .55.

Miscellaneous

Biesheuvel (9) found that perseverators had a lower threshold for flicker than nonperseverators. In the ability to recognize faces, Howells (58) found some indication that women were superior to students and farm people and that fraternity people were superior to nonfraternity people. The validity of the Noll Test of Scientific Thinking was tested by Blair (11) by using the test taken by recognized scientific authorities. The results showed the validity of the test to be questionable. The use of the lie detector as an accurate measure was questioned by Forkosch (42) and Ruckmick (96). The latter found in a series of investigations that the detector was only 83 percent correct.

Salesmanship—A study of the factors making for success in sales work was made by Mitchell (75). He found that a vocabulary test, a word association test, a word series test (giving the names of as many things that begin with "s" as possible in one minute), and an ink blot test were of some significance. Wallace and Travers (122) also worked on this problem. They found that specialty salesmen were highly obsessional. It is, of course, another thing to say that such a trait is necessary before entering into employment. Dodge (23) concluded that social dominance is not associated with sales ability because he found a correlation of only .16 $\pm$ .16 between this trait and success in selling. This conclusion is contrary to the previous work in this area.

Aviation and automobile driving—The Waltring Rotoscope, the Keystone Tel-Eye-Trainer and Stereoscope, and the American Optical Master Model Stereo-Orthopter were used to advantage in the testing and training of aviators according to Schwichtenberg (98). Swope (113) prepared a test dealing exclusively with judgment factors in automobile driving. The selection of the items was made on the basis of opinions as to the value of the item obtained from commercial and noncommercial drivers and a cross section of university students. Allgaier (1) analyzed the results of 15 tests administered to 22,000 drivers in 70 cities and found that the abilities required for safe driving were most highly developed between the ages of twenty and forty. Other testing programs for automobile drivers were described by C. W. Brown and by others (13, 19, 41, 59). C. A. Drake (27) concluded that accident-proneness is associated with the discrepancies between perception and motor reaction and that the discrepancies can be determined by tests. If Drake's conclusion is sound it means that automobile drivers could be made aware of their weakness and industrial workers placed in jobs with due regard for their accident-proneness.

Bibliography

1. ALLGAIER, EARL. "A. A. A. Finds Drivers' Skill Varies with Age." *Public Safety* 14: 30; May 1938.
2. ANDERBERG, R., and WESTERLUND, G. "Psychological Testing of Abilities and Personnel Selection in the Textile Industry." *Acta Psychology Hague* 5: 16-52; 1940.
3. BAKER, HARRY J.; VOELKER, PAUL H.; and CROCKETT, ALEX C. *Detroit General Aptitudes Examination.* Bloomington, Ill.: Public School Publishing Co., 1938.
4. BARR, A. S. "The Wisconsin Study of Teaching Ability." *Official Report of 1940 Meeting.* Washington, D. C.: American Educational Research Association, a Department of the National Education Association, 1940. p. 99-103.
5. BARR, A. S. "The Wisconsin Study of Teaching Ability." *Journal of Educational Research* 33: 671-84; May 1940.
6. BELL, HUGH M. *The Theory and Practice of Personnel Counseling.* Stanford University, Calif.: Stanford University Press, 1939. 167 p.
7. BELLOWS, R. M. "The Status of Selection and Counseling Techniques for Dental Students." *Journal of Consulting Psychology* 4: 10-16; January-February 1940.
8. BETTS, EMMETT ALBERT. *Data on Visual Sensation and Perception Tests. Part II, Visual Efficiency.* Meadville, Pa.: Keystone View Company, 1940. 66 p.
9. BIESHEUVEL, S. "The Measurement of the Threshold for Flicker and Its Value as a Perseveration Test." *British Journal of Psychology* 29: 27-38; July 1938.
10. BINGHAM, WALTER V. "Testing in Vocational Guidance." *Education* 58: 539-44; May 1938.
11. BLAIR, GLENN M. "The Validity of the Noll Test of Scientific Thinking." *Journal of Educational Psychology* 31: 53-59; January 1940.
12. BROWN, C. H., and BROWN, R. H. "Relation between Achievement of Medical Students in Pre-Clinical Medicine and Achievement in Clinical Medicine." *Psychological Record* 3: 147-50; March 1939.
13. BROWN, CLARENCE W. "Results from the Use of Special Tests for Automobile Drivers." *Psychological Bulletin* 36: 523-24; July 1939.
14. BRYAN, ALICE I., and PERL, R. E. "Comparison of Women Students Preparing for Three Different Vocations." *Journal of Applied Psychology* 22: 161-68; April 1938.
15. CLIFTON, L. L. "Prediction of High School Marks in Elementary Algebra." *Journal of Experimental Education* 8: 410-13; June 1940.
16. CONGDON, NORA A. "A Study of Cleeton's Vocational Interest Inventory." *Occupations* 18: 347-52; February 1940.
17. DAVIDSON, CHARLES M. "Analysis of Clerical Tests." *Personnel Journal* 16: 95-98; September 1937.
18. DAVIDSON, CHARLES M. "Evaluation of Clerical Tests." *Personnel Journal* 16: 57-64; June 1937.
19. DE SILVA, HARRY R. "Mechanical Tests for Drivers." *Technology Review* 40: 309-11; May 1938.
20. DEWAR, HEATHER. "A Comparison of Tests of Artistic Appreciation." *British Journal of Educational Psychology* 8: 29-49; February 1938.
21. DICKTER, M. RICHARD. "Relationship Between Scores on the Scholastic Aptitude Test and College Grades in Mathematics." *Journal of Educational Psychology* 29: 363-73; May 1938.
22. DODDS, G. S. "Aptitude Test Scores, Pre-Medical Grades and First Year Medical Grades During Six Years at West Virginia University." *Journal of the Association of American Medical Colleges* 14: 219-30; July 1930.
23. DODGE, ARTHUR F. "Social Dominance and Sales Personality." *Journal of Applied Psychology* 22: 132-39; April 1938.
24. DOUGLAS, BEVERLY. "A Study of the Predictive Value of the Medical Aptitude Test at Vanderbilt School of Medicine." *Journal of the Association of American Medical Colleges* 13: 380-90; November 1938.
26. DRAKE, CHARLES A. "Inspection for Inspectors." *American Machinist* 82: 766-68; August 24, 1938.
27. DRAKE, CHARLES A. "The Prediction and Control of Accidents." *Scientific Monthly* 51: 74-76; July 1940.

28. DRAKE, CHARLES A., and OLEEN, H. D. "The Technique of Testing." *Factory Management and Maintenance* 96: 71-78; March 1938.
29. DRAKE, RALEIGH M. "Factor Analysis of Music Tests." *Psychological Bulletin* 36: 608-609; October 1939.
30. DRAKE, RALEIGH M. "Factorial Analysis of Music Tests by the Spearman Tetrad-Difference Technique." *Journal of Musicology* 1: 6-10; May 1939.
31. DRAKE, RALEIGH M. "The Relation of Musical Talent to Intelligence and Success in School." *Journal of Musicology* 2: 38-44; May 1940.
32. DUFFY, ELIZABETH, and CRISSY, W. J. E. "Evaluative Attitudes as Related to Vocational Interests and Academic Achievement." *Journal of Abnormal and Social Psychology* 35: 226-45; April 1940.
33. DWYER, PAUL S. "Analysis of 19 Occupational Scores of the Strong Vocational Interest Test Given to 418 Students Entering the University of Michigan Medical School During the Years 1928, 1929, 1930." *Journal of Applied Psychology* 22: 8-16; February 1938.
34. EAMES, THOMAS H. "The Reliability and Validity of the Eames Eye Test." *Journal of Educational Research* 33: 524-27; March 1940.
35. ENGLISH, B. C., and OTHERS. "Evaluation of Three Methods Commonly Used in Examination of Eyes of School Children." *Archives of Ophthalmology (Chicago)* 22: 1068-73; December 1939.
36. ESPENSCHADE, A. *Motor Performance in Adolescence, Including the Study of Relationships with Measures of Physical Growth and Maturity.* Monograph of the Society for Research in Child Development, Vol. 5, No. 1. Washington, D. C.: National Research Council, 1940. 126 p.
37. EYSENCK, H. J. "The General Factor in Aesthetic Judgment." *British Journal of Psychology* 31: 94-102; July 1940.
38. FARNSWORTH, P. R. "Changes in Musical Taste." *Journal of Musicology* 1: 1-4; September 1939.
39. FERREE, C. E., and RAND, G. "Testing Fitness for Night Flying." *American Journal of Ophthalmology* 22: 655-60; June 1939.
40. FERREE, C. E., and RAND, G. "The Testing of Fitness for Night Flying: The Light Sense." *American Journal of Opthalmology* 20: 58-79; January 1938.
41. FLETCHER, E. D., and BROWN, C. W. "Some Results from the Use of Special Tests for Automobile Drivers in the State of California." *Psychological Bulletin* 36: 641; October 1939.
42. FORKOSCH, M. D. "The Lie Detector and the Courts." *New York University Contemporary Law Pamphlet.* Series 1, No. 13. New York: New York University, 1939. 30 p.
43. FRAZER, JANE; OGDEN, JEAN; and ROBINSON, F. P. "The Testing of Binocular and Monocular Oral Reading Skill." *Journal of Educational Research* 33: 528-30; March 1940.
44. GARRISON, KARL C. "Use of Psychological Tests in the Selection of Student Nurses." *Journal of Applied Psychology* 23: 461-72; August 1939.
45. GENTRY, CURTIS G. *Vocational Inventory.* Minneapolis, Minn.: Educational Test Bureau, 1940.
46. GLASSOW, RUTH B.; COLVIN, VALARIE; and SCHWARZ, M. M. "Studies in Measuring Basketball Playing Ability of College Women." *Research Quarterly of the American Association of Health and Physical Education* 9: 60-68; December 1938.
47. GREENE, EDWARD B. *Michigan Vocabulary Profile Test.* Yonkers-on-Hudson, N. Y.: World Book Co., 1939.
48. GREENE, EDWARD B. "Predicting the Student's Success." *Journal of Higher Education* 11: 252-56; May 1940.
49. GREENE, EDWARD B. "Vocabulary Profile in Groups in Training." *Journal of Educational Research* 33: 569-75; April 1940.
50. HALES, W. M. "Clerical Tests in State Reformatory." *Personnel Journal* 16: 316-24; April 1938.
51. HARRELL, W. "A Factor Analysis of Mechanical Ability Tests." *Psychometrika* 5; 17-33; March 1940.
52. HAYES, LESLIE, and DRAKE, C. A. "McCauley Tetrahedron Test." *Journal of Experimental Education* 7: 206-209; March 1939.

53. HILDRETH, GERTRUDE H., and AXELSON, A. J. "Improved Visual Acuity Tests for Young Children." *Teachers College Record* 40: 229-36; December 1938.
54. HISCOCK, W. G. "Selection Tests for Chemical Process Workers." *Occupational Psychology (London)* 12: 178-86; Summer 1938.
55. HITZ, JOHN B. "An Evaluation of Vision-Testing Methods in Schools." *American Journal of Ophthalmology* 21: 1024-27; September 1938.
56. HOLLIDAY, FRANK. "An Investigation with the Selection of Apprentices for the Engineering Industry." *Occupational Psychology (London)* 14: 69-81; April 1940.
57. HOLMGREN, L. "Hearing Tests and Hearing Aids. A Clinical and Experimental Study." *Acta oto-laryng (Stockholm)* Suppl. 34: 164; 1939.
58. HOWELLS, THOMAS H. "A Study of Ability to Recognize Faces." *Journal of Abnormal and Social Psychology* 33: 124-27; January 1938.
59. JOHNSON, LE VERNE. "Driver Tests and Accidents." *Public Safety* 14: 18-19; June 1938.
60. JOHNSON, WENDELL, and BISSELL, V. L. "Iowa Hand Usage Dextrality Quotients of One Hundred High-School Students." *Journal of Educational Psychology* 31: 148-52; February 1940.
61. JOHNSON, WENDELL, and DUKE, DARLENE. "Revised Iowa Hand Usage Dextrality Quotients of Six-Year-Olds." *Journal of Educational Psychology* 31: 45-52; January 1940.
62. KELLAR, WYLMA R. "The Relative Contribution of Certain Factors to Individual Differences in Algebraic Problem Solving Ability." *Journal of Experimental Education* 8: 26-35; September 1939.
63. KUDER, G. FREDERIC. "The Stability of Preference Items." *Journal of Social Psychology* 10: 41-50; February 1939.
64. KWALWASSER, JACOB. "From the Realm of Guess into the Realm of Reasonable Certainty." *Music Educators Journal* 24: 16-17; February 1938.
65. KWALWASSER, JACOB. "The Tendency Toward Mediocrity." *Yearbook, Vol. 30.* Chicago: Music Educators National Conference (64 E. Jackson Blvd.), 1937. p. 87-88.
66. LARK-HOROVITZ, BETTY. "On Art Appreciation of Children: II. Portrait Preference Study." *Journal of Educational Research* 31: 572-98; April 1938.
67. LARSON, WILLIAM S. "Practical Experience with Music Tests." *Music Educators Journal* 24: 31, 68-74; March 1938.
68. LAYCOCK, SAMUEL R., and HUTCHEON, N. B. "A Preliminary Investigation into the Problem of Measuring Engineering Aptitude." *Journal of Educational Psychology* 33: 280-88; April 1939.
69. MCCASKILL, CARRA LOU, and WELLMAN, BETH L. "A Study of Common Motor Achievements at the Preschool Ages." *Child Development* 9: 141-50; June 1938.
70. MARTIN, PEARL M. "Appraisal of Musical Aptitude." *University High School Journal* 18: 203-208; June 1940.
71. MATHEWS, LEE H. "An Item Analysis of Measures of Teaching Ability." *Journal of Educational Research* 33: 576-80; April 1940.
72. MEIER, NORMAN C. "Factors in Artistic Aptitude: Final Summary of a Ten-Year Study of a Special Ability." *Studies in the Psychology of Art, Vol. 3, Psychological Monographs.* Vol. 51, No. 5. Columbus, Ohio: American Psychological Association, Ohio State University, 1939. p. 140-58.
73. METHENY, ELEANOR. "Studies of the Johnson Test as a Test of Motor Educability." *Research Quarterly of the American Association for Health and Physical Education* 9: 105-14; December 1938.
74. MILLER, CARROLL H. "Value of Certain Standard Tests for a Study of Dramatic Talent." *Journal of Social Psychology* 9: 437-49; November 1938.
75. MITCHELL, J. H. "An Experiment in the Selection of Sales Managers." *Occupational Psychology (London)* 12: 308-18; Autumn 1938.
76. MOLISH, H., and REESE, E. "A Comparison of the Betts Tests of Visual Sensation and Perception with a Standard Clinical Examination." *American Journal of Optometry* 16: 110-17; 1939.
77. MONTGOMERY, H. C. "Analysis of World's Fair's Hearing Tests." *Science Monthly* 50: 335-39; April 1940.
78. MOORE, JOSEPH E. "A Note on the Reliability of the Knauber Art Vocabulary Test." *Journal of Educational Psychology* 29: 631-35; November 1938.

79. MORRIS, LEON M. "Prognosis in First Year Algebra." *Ohio Schools* 18: 20-21; January 1940.
80. MORROW, R. S. "An Analysis of the Relations Among Tests of Musical, Artistic, and Mechanical Abilities." *Journal of Psychology* 5: 253-63; April 1938.
81. MOSS, F. A. "Report of the Committee of Aptitude Tests for Medical Schools." *Journal of the Association of American Medical Colleges* 15: 249; July 1940.
82. MURSELL, JAMES L. "What About Music Tests?" *Music Educators Journal* 24: 16-18; October 1937.
83. NATIONAL EDUCATION ASSOCIATION and AMERICAN MEDICAL ASSOCIATION, JOINT COMMITTEE ON HEALTH PROBLEMS IN EDUCATION. *Conserving the Sight of School Children.* New York: National Society for the Prevention of Blindness, 1929.
84. OAK, LURA. "An Appraisal of the Betts Visual Sensation and Perception Tests as a Sorting Device for Use in Schools." *Journal of Educational Psychology* 30: 241-50; April 1939.
85. OAK, LURA, and SLOANE, A. E. "The Betts Visual Sensation and Perception Tests: A Method of Detecting School Children Requiring Ocular Attention." *Archives of Ophthalmology (Chicago)* 22: 832-43; November 1939.
86. O'CONNOR, J. "An Analysis of the Second Trial of the Block Cube, Worksample 167." *Technical Report of Human Engineering Laboratory,* No. 18. 1938. 100 p.
87. O'CONNOR, J. "Administration and Norms for the Finger Dexterity Test, Worksample 16, and the Tweezer Dexterity Test, Worksample 18." *Technical Report of the Human Engineering Laboratory,* No. 16. 1938. 136 p.
88. O'ROURKE, LAWRENCE J. "Vocational Aptitude Tests." *Review of Educational Research* 8: 257-68, 334-40; June 1938.
89. PACKARD, ALBERT G. "Aptitude Testing." *Baltimore Bulletin of Education* 16: 90-94; November 1938.
90. PATERSON, DONALD G.; SCHNEIDLER, GWENDOLEN G.; and WILLIAMSON, EDMUND G. *Student Guidance Techniques.* New York: McGraw-Hill Book Co., 1938. 316 p.
91. PHILIP, BROTHER ROGER. "A Comparison of Color-Blind Tests." *American Journal of Psychology* 51: 482-88; July 1938.
92. PHILIP, BROTHER ROGER. "Sex Differences in the Perception of Color Mass." *American Journal of Psychology* 51: 398-404; April 1938.
93. POWELL, ELIZABETH, and HOWE, E. C. "Motor Ability Tests for High School Girls." *Research Quarterly of the American Association for Health, Physical Education, and Recreation* 10: 81-88; December 1939.
94. ROSSETT, NATHANIEL E., and ARAKELIAN, PETER. "A Test Battery for the Selection of Panel Dial Switchmen." *Journal of Applied Psychology* 23: 358-66; June 1939.
95. RUCH, GILES M., and SEGEL, DAVID. *Minimum Essentials of the Individual Inventory in Guidance.* U. S. Dept. of the Interior, Office of Education, Vocational Division Bulletin No. 202. Washington, D. C.: Government Printing Office, 1940. 83 p.
96. RUCKMICK, CHRISTIAN A. "The Truth About the Lie Detector." *Journal of Applied Psychology* 22: 50-58; February 1938.
97. SCHWARTZ, FREDERICK O. "Ocular Factors in Poor Readers in Saint Louis Public Schools." *American Journal of Ophthalmology* 23: 535-38; May 1940.
98. SCHWICHTENBERG, A. H. "Training for Aviators." *American Journal of Ophthalmology* 21: September 1938.
99. SEAGOE, MAY V. "Prediction of Achievement in Elementary Algebra." *Journal of Applied Psychology* 22: 493-503; October 1938.
100. SEASHORE, CARL E. "Musical Intelligence." *Music Educators Journal* 24: 32-33; March 1938.
101. SEASHORE, CARL E.; LEWIS, D.; and SAETBEIT, J. G. *Seashore Measures of Musical Talents.* Revised edition. Camden, N. J.: Education Department, Radio Corporation of America Manufacturing Co., 1939.
102. SEASHORE, CARL E. "The Psychology of Music. XXIV. Measures of Musical Achievement." *Music Educators Journal* 26: 24, 78; February 1940.
103. SEGEL, DAVID, and PROFFITT, MARIS M. *Some Factors in the Adjustment of College Students.* U. S. Dept. of the Interior, Office of Education, Bulletin, 1937, No. 12. Washington, D. C.: Government Printing Office, 1938. 49 p.

104. SEMEONOFF, B. "A New Approach to the Testing of Musical Ability." *British Journal of Psychology* 30: 326-40; April 1940.
105. SHANNON, JOHN R. "A Comparison of Highly Successful Teachers, Failing Teachers and Average Teachers at the Time of Their Graduation from Indiana State Teachers College." *Educational Administration and Supervision* 26: 43-51; January 1940.
106. SHARKEY, VINCENT J., and DUNLAP, J. W. "Study of the Reliability and Validity of the Academic Preference Blank." *Journal of Educational Psychology* 31: 103-10; February 1940.
107. SILVERMAN, S. RICHARD. "Inadequacies of Current Hearing Tests for School Children." *Journal of the Exceptional Child* 6: 22-25; October 1939.
108. SLATER, P. "Some Group Tests of Spatial Judgment or Practical Ability." *Occupational Psychology (London)* 14: 39-55; January 1940.
109. STEAD, WILLIAM H., and OTHERS. *Occupational Counseling Techniques: Their Development and Application.* New York: American Book Co., 1940. 273 p.
110. STEGGERDA, MORRIS, and MACOMBER, EILEEN. "A Revision of the McAdory Art Test Applied to American Indians, Dutch Whites and College Graduates." *Journal of Comparative Psychology* 26: 349-53; October 1938.
111. STROMBERG, ELEROY L. "The Relationship of Measures of Visual Acuity and Ametropia to Reading Speed." *Journal of Applied Psychology* 22: 70-78; February 1938.
112. STUIT, DEWEY B., and DONNELLY, M. C. "Performance in the Iowa Qualifying Examination of Majors in Various Academic Departments with Implications for Counseling." *Journal of Experimental Education* 8: 293-99; March 1940.
113. SWOPE, A. *Judgment Test on Safe Driving Practices.* Bloomington, Ill.: McKnight and McKnight, 1939. 8 p.
114. TAYLOR, HAROLD C., and RUSSELL, J. T. "Relationship of Validity Coefficients to the Practical Effectiveness of Tests in Selection: Discussion and Tables." *Journal of Applied Psychology* 23: 565-78; October 1939.
115. "Tests and Analysis of General Motor Ability." *Research Quarterly of the American Association for Health and Physical Education* 9: 49-56; Supplement, March 1938.
116. TIFFIN, JOSEPH, and GREENLY, R. J. "Employee Selection Tests for Electrical Fixture Assemblers and Radio Assemblers." *Journal of Applied Psychology* 23: 240-63; April 1939.
117. TRAXLER, ARTHUR E. "The Correlation Between Achievement Scores and School Marks in an Independent School for Boys." *Journal of Applied Psychology* 24: 58-63; February 1940.
118. TURSE, PAUL L. *Turse Shorthand Aptitude Test.* Yonkers-on-Hudson, N. Y.: World Book Co., 1940.
119. UPDEGRAFF, RUTH; HEILIGER, L.; and LEARNED, J. "The Effect of Training Upon the Singing Ability and Musical Interest of Three-, Four-, and Five-Year-Old Children." *Studies in Preschool Education I.* Studies in Child Welfare, Vol. 14. Iowa City, Iowa: University of Iowa, 1938. p. 83-131.
120. VAN DER LUGT, M. J. A. *Un Profil Psychomoteur; D'Apres une Étude Motometrique de l'habilite Manuelle, Aubei Editions Montaigne, Paris 1939.* New York: the Psychological Corporation.
121. VARNUM, WILLIAM H. *Selective Art Aptitude Measures.* Scranton, Pa.: International Textbook Co., 1939.
122. WALLACE, N., and TRAVERS, R. M. W. "A Psychometric Sociological Study of Salesmen." *Annals of Eugenics (Cambridge)* 8: 266-302; 1938.
123. WILLIAMSON, EDMUND G.; STOVER, R. D.; and FISS, C. B. "Selection of Student Nurses." *Journal of Applied Psychology* 22: 119-31; April 1938.