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Historical Aspects and Test Characteristics of Eponymously Named Psychometric Tests by Women: The Period up to 1970

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Abstract

Background: Prior to 1970, women authored or co-authored a variety of eponymously named psychometric tests predominately in children and young adults with developmental and behavioral disorders. Gaps remain in understanding and appreciating the extent of their contributions to these psychometric tests.

Methods: Two authors adjudicated psychometric tests in the text, *Tests in Print*, to identify those eponymously named after women. To be eligible for this study, the psychometric test title must contain the name of a woman and be published prior to 1970. If a woman published more than one eponymously named test, the earliest one, if available, was chosen to be included in this study. A search for individual and a combination of related Medical Subject Headings (MeSH) keywords of the "name of the women author" and "name of the test" was performed using the Google web browser, PubMed, APA PsycNet, and APA PsycInfo from inception to August 1, 2021. Further papers were identified using bibliographic search from source papers and reference books.

Results: Three hundred eighty-six eponymously named psychometric tests were identified, with 124 (32%) of them named in whole or in part by or for a woman. Of these 124 psychometric tests, 93 represent unique women's names. Before 1970, there were twenty-three (19%) eponymously named psychometric tests with women, with twenty-one (17%) representing unique women's names.

Conclusion: These tests were published by women whereby they served either as a single author or in collaboration with others or their spouse. In the latter case, the woman's name universally appeared after their husband's name. In only a few cases, are these women's names well-referenced in biographical source materials. These women made essential contributions to the development and revision of psychometric tests and the field of psychology in general.

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Introduction

Originating from an ancient Greek word meaning "named after", eponyms are used in various settings, including algorithms, instruments, surgical procedures, signs, syndromes, and diseases. The eponym is nearly always applied using the author's surname and, in general, is bestowed by another person or posthumously in honor of an individual(s) contribution(s) to a particular field or society as a whole. Eponymously named psychometric tests represent a small fraction of the overall number of tests appearing in *Tests in Print*. A psychometrically named eponymous test first appeared within *Tests in Print* in 1911, and the first one named after a woman occurred in 1926.

There are several limitations related to using eponymously named psychometric tests. First, it is impossible to discern whether a woman was an author on a test or if one or two people share the same surname (e.g., *Thurstone Test of Mental Alertness*, *Crawford Small Parts Dexterity Test*, the Beery-Buktenica Developmental Test of Visual-Motor Integration, *Eysenck Personality Inventory*). In these cases, the singular rather than the plural form of the named test was used, and thus both authors' names were not acknowledged. Second, women assumed their husbands' surname rather than retaining their maiden name, a common practice before the mid-to-late twentieth century. In those

cases, the women often kept their maiden name as their middle name. Third, eponymous names can cause further confusion for failure to recognize that the same surname represents two different people from the same family—the Cattell Infant Intelligence Scale was revised by Psyche Cattell, the daughter of James McKeen Cattell, a renowned scientist in psychological testing who coined the term "mental test."

There are inherent challenges in completing a review that focuses exclusively on women who developed psychometric tests nearly a century ago. Women have made substantive accomplishments in psychology, although their achievements are often overlooked, not well known, documented, or overshadowed by their spouses. Except for a few more widely recognized names within the psychological testing literature and lay press (e.g., Goodenough, Myers-Briggs), there remains a gap in the literature regarding the biographies of many of these women because of the paucity of historical information available. Despite these limitations, we present twenty-one eponymous names for psychological tests that appeared before 1970.

The purpose of this paper was not to summarize every salient aspect of these psychological tests but to inform the reader in the author's own words of the intent and purpose of the test. This review attempted to locate the text's original publication to the extent possible, even though most tests have undergone multiple revisions and updates. The primary source was not available in some cases (e.g. Boehm). The version closest to the initial one available was accessed in those cases.

This paper aimed to understand the impetus and gap(s) filled by these women authors in the development of their novel psychometric tests. Historical information about the women who developed and described the test provided a perspective regarding their educational background and experiences, critical to the test development, was summarized. If available, information about these women's character was intended to give the reader a perspective of how their lives impacted others. It is impossible to pay sufficient homage to these women's accomplishments and their life's work in this brief overview. Furthermore, in the tests where women collaborated with their spouses, one cannot always fully appreciate their contribution to all aspects of their research and publication as their spouse overshadows it.

Historical Aspects of Psychometric Tests

Psychometric testing represents a more modern concept in psychology, which began in the late nineteenth century. Francis Galton (1822–1911) is credited for being the first to devise and promote the statistical concepts of bivariate distribution and correlation coefficient, which established standardized objective measurements of human physical and behavioral characteristics (1,2). These principles were the foundation by which other concepts such as validity and reliability would stem. James McKeen Cattell (1860–1944), in his 1890 paper titled "Mental tests and measurement," was the first to use the term "mental test" when he enumerated that this form of experimental research is essential to the field of psychology in order to better understand the psychological aspects of human behavior and its mental constructs:

> Psychology cannot attain the certainty and exactness of the physical sciences, unless it rests on a foundation of experiment and measurement. A step in this direction could be made by applying a series of mental tests and measurements to a large number of individuals. The results would be of considerable scientific value in discovering the constancy of mental processes, their interdependence, and their variation under different circumstances. Individuals besides, would find their tests interesting, and perhaps, useful in regard to training, mode of life, or indication of disease. The scientific and practical value of such tests would be much increased should a uniform system be adopted, so that determination made at different times and places could be compared and combined (3, p. 373).

He developed fifty "mental tests" that covered measurements involving sensory acuity (sight, hearing, taste, smell, touch, and temperature), psychophysical aspects (sense of effort and movement), and mental process measurement (mental time, mental intensity, and mental extensity) (3,4). Of these fifty measurements, he identified ten within these categories of which he considered essential tests named sensory acuity (e.g., sensation-areas and pressure causing pain), psychophysical aspects (e.g., reaction time for sound and time for naming colors), and mental process measurements (e.g., visual bi-section of a line, judgment in a short-time period, and number of letters recalled).

Alfred Binet and Théodore Simon were tasked to identify children who were slower learners so that special education programs could be developed to meet their needs. As reported in their 1904 paper titled "Méthodes nouvelles pour le diagnostic du niveau intellectuel des anormaux" (New methods for the diagnosis of the intellectual level of abnormal people), the authors defined the purpose and intent of their test:

When a child is brought into our presence, our goal is to measure their intellectual capacities to know if they are normal or mentally disabled. (…) We limit ourselves to gathering the truth about their present mental state (5, p. 191). Our aim is by no means to study, analyze, and identify the aptitudes of inferior intelligence. This will be the subject of further work.

Here we will confine ourselves to appreciating and measuring their intelligence in general. We will identify and compare their intellectual level to normal children of the same age or a similar age level. The reservations we made above about the proper notion of a development arrest will not prevent us from findings significant advantages when making a methodological comparison between lower intelligence and normal intelligence (5, p. 193).

Binet and Simon devised a series of thirty tests arranged in ascending order of difficulty to assess the mental capacity and performance of children in the areas of comprehension, judgment, reasoning, and invention-factors that are involved in the ability of an individual to adapt to one's circumstances, a reflection of intelligence. This test was revised by Frederick Ter-

man (1877–1956) at Stanford and renamed the Stanford-Binet Intelligence Scales in 1916 (6). From this beginning the field of psychometric testing morphed over time to now encompass over 3,000 different tests.

Materials and Methods

Tests in Print is considered the source master index for the in-print tests appearing in the *Mental Measurements Yearbook* (7). The *Mental Measurements Yearbook*, updated and published every three years, provides a descriptive summary and critical appraisal of each psychological test (7,8). This reference book contains a comprehensive bibliography of all known commercially available psychological tests in every conceivable genera, including intelligence, general aptitude, neuropsychological, and developmental (7). *Tests in Print* contains information about each test, including its purpose, population, publication date, acronym, score, administration type, forms, publisher, in-print status, price, intended population, administration time, publication date(s), publisher, author, and cross-references (7).

To be eligible for inclusion in this study, the psychometric test title must contain the name of a woman and be published prior to 1970. Tests which did not meet these criteria were excluded from this study. If a woman published more than one eponymously named test, the earliest one, if available, was chosen to be included in this study. A search for individual and a combination of related Medical Subject Headings (MeSH) keywords of the "name of the women author" and "name of the test" was performed using the Google web browser, APA PsycNet, and APA PsycInfo from January 1, 1927 to August 1, 2021. Further papers were identified using bibliographic search from source papers and reference books. For each name, a biographical search was performed to obtain additional biographical information. The search included obituaries, awards, or accommodations, and for those names whose gender was not apparent, a photographic search was also conducted. Two authors independently screened to eliminate duplicated names and ensure eligible names met inclusion and exclusion criteria.

Results

Eponymously named psychological tests represent a minority, 386 (13%) of the 3,003 tests found in *Tests in Print* VIII, published in 2011. Feasibility analysis identified that of the 386 eponymously named psychological tests, 124 (32%) of them contained a woman(s) name singularly or as part of a team of collaborator(s). Of these 124 psychological tests, 93 represent unique women's names. Before 1970, there were twenty-three (19%) eponymously named psychological tests with women, and twenty-one (17%) represent unique women's names (Table 1).

Discussion

Herein is presented the twenty unique eponymously named psychometric tests within *Tests in Print*. The tests are discussed sequentially based on the earliest year they were published. For each test, a brief biographical sketch of the women is followed by the purpose of the test, along with salient aspects of the test in the author's own words. This is concluded with a summary clarifying the test's role in current clinical psychological practice.

Gates-MacGinitie Reading Test

Ruth (Kilpatrick) MacGinitie, author and teacher, assisted students with reading comprehension difficulties (9). No information is available regarding her formal education or training. Arthur Gates published his *Silent Reading and Primary Reading* Tests in 1926, which later evolved into the *Gates Reading Survey* in 1939 (10). In collaboration with Walter H. MacGinitie (1928–2020), the *Gates-MacGinitie Reading Test* (GMRT) was developed and published in 1965 (11). Ruth K. MacGinitie served as author of the revised third edition of the GMRT published in 1989 (12). Although her name did not appear on the second edition of the GMRT published in 1978, she played a major role in its development (13,14). As explained in the fourth edition, originally published in 2000 with authors including the MacGinitie's, Katherine Maria, and Lois G. Dreyer, the test's purpose is to determine the level of reading achieved for students. Information from this test:

> [i]s useful for teachers and schools to know the general level of reading achievements of individual students throughout their school careers. The objective information obtained from the tests, complemented by teacher's evaluations and other sources of information is an important basis for, selecting students for further individual diagnosis and special instruction, planning instructional emphases, locating students who are ready to work with more advanced materials, making decisions about grouping students, talking with students about their progress in reading, deciding which levels of instructional materials to use with new students, evaluating the effectiveness of instructional programs, reporting to parents and the community (9, p. 2).

This test evaluates reading comprehension, vocabulary, phonic and phonemic awareness, and can be administered individually or in a group setting and assesses reading from kindergarten through high school. It is used to evaluate teaching effectiveness, determine a child's grade level, and their strengths and weakness in various aspects of reading (15).

Goodenough-Harris Drawing Test

Florence Laura Goodenough (1886–1959) was born in Honesdale, Pennsylvania, and received her doctorate in 1924 at Stanford University under the aegis of Lewis Madison Terman (1877–1956) (16,17). She worked at the Minneapolis Child Guidance Clinic, Minnesota, as a chief psychologist from 1924 to 1925, and the University of Minnesota Institute of Child Welfare from 1925 to 1947, achieving the rank of full professor in 1931 (17-20). At the time of the publication of her critically acclaimed book titled *Measurement of Intelligence by Drawings*, she served as Research Assistant Professor at the Institute of Child Welfare at the University of Minnesota. During that

Table 1. Eponymous named women psychometric tests prior to 1970.

Test name	Authors	Year
Gates-MacGinitie Reading Tests, Fourth Edition, Forms S and T	Walter H. MacGinitie, Ruth K. MacGinitie, Katherine Maria, Lois G. Dreyer	1926
Goodenough-Harris Drawing Test	Florence L. Goodenough, Dale B. Harris (test)	1926
McCall-Crabbs *Standard Test Lessons in Reading*	William A. McCall, Lelah Crabbs Schroeder; revision by Robert P. Starr	1926
Kuhlmann-Anderson Tests, Eighth Edition	F. Kuhlmann (fourth and earlier editions), Rose G. Anderson	1927
Myers-Briggs Type Indicator, Form M	Katharine C. Briggs, Isabel Briggs Myers, (Mary H. McCaulley, Naomi L. Quenk, Allen L. Hammer - revised manual)	1943
Thurstone Test of Mental Alertness	Thelma Gwinn Thurstone, L.L. Thurstone	1943
Cattell Infant Intelligence Scale	Psyche Cattell	1946
Crawford Small Parts Dexterity Test	John E. Crawford, Dorothea M. Crawford	1946
Gilmore Oral Reading Test	John V. Gilmore, Eunice C. Gilmore	1951
Griffiths Mental Development Scales [Revised]	Ruth Griffiths, Michael Huntley (Birth-2 years Scale [Scale 1] and manual, 1996 Revision)	1951
Neale Analysis of Reading Ability: Second Revised British Edition	Marie D. Neale (test and manual); Second Revised British Edition and standardization by Chris Whetton, Louise Caspall, Kay McCulloch	1958
Gates-McKillop-Horowitz Reading Diagnostic Test, Second Edition	Arthur I. Gates, Anne S. McKillop, Elizabeth Cliff Horowitz	1962
Slingerland Screening Tests for Identifying Children with Specific Language Disability	Beth H. Slingerland	1962
Eysenck Personality Inventory	Hans Jürgen. Eysenck, Sybil B.G. Eysen	1963
Jungian Type Survey: The Gray-Wheelwrights Test (16th Revision)	Horace Gray (test only), Joseph B. Wheelwright (test and manual), Jane H. Wheelwright (test and manual), John A. Bueler (manual only)	1964
Beery-Buktenica Developmental Test of Visual-Motor Integration, 5th Edition	Keith E. Beery, Natasha A. Beery	1967
Boehm Test of Basic Concepts - Third Edition	Ann E. Boehm	1967
Hall Occupational Orientation Inventory, Form II and Young Adult/College/Adult Form (Fourth Edition)	Lacy G. Hall	1968
Bayley Scales of Infant and Toddler Development - Third Edition	Nancy Bayley	1969
Goldman-Fristoe Test of Articulation - Second Edition	Ronald Goldman, Macalyne Fristoe	1969
Piers-Harris Children's Self-Concept Scale - Second Edition	Ellen V. Piers (test and manual), David S. Herzberg (test and manual), Dale B. Harris (Test)	1969

time, her other noteworthy accomplishments included developing the Minnesota Preschool Scale and authoring two books including, *Experimental Child Study and Anger in Young Children*, published in 1931, and the *Handbook of Child Psychology* published in 1933. She was bestowed the title professor emeritus in 1947 (21). Throughout her career, she published nine books, with *Developmental Psychology* being highly regarded within the field of psychology (20).

Goodenough served as the first president of the newly formed National Council of Women Psychologists (NCWP) in 1941 (later known as the International Council of Psychologists in 1959), which served as the platform and voice for women psychologists who sought equal opportunity in the field during and after WWII (16). She also served as president of the Society of Research in Child Development from 1946 to 1947 and the American Psychological Association's Division on Childhood and Adolescence (17,20,21). In the word of Dale Harris, a former student, colleague, and collaborator who described her

character:

> As a scientist and scholar, Florence Goodenough was rigorous and exacting, as a teacher, counselor, and friend she was human, and humane, though always setting high standards. Devastating in criticism of careless or shoddy work, she was unfailingly patient and helpful wherever she saw promise of growth. Endowed with that wise and balanced perspective which, although exceedingly rare, is sometimes carelessly called "common sense," she enriched all who sought her counsel. She delighted in sharing her wide-ranging interests and avocations with her friends, who were greatly rewarded by her insights (22, p. 306).

Her primary expertise was in research methodology, and her interest was in child development and advocacy for the rights and welfare of children (23). She is undoubtedly best recognized for her development of event sampling and the "Draw-a-Man (Person) Test" published in her 1926 book *Measurement of Intelligence by Drawings*. This was conceived as her doctoral thesis under the aegis of Lewis Terman, best recognized for his studies on gifted children and revision of the Stanford-Binet Intelligence Scale (16,21,24). Goodenough investigated intellectual factors as shown in children's drawings which served as a marker of mental ability and maturity, and study of race, sex, and individual differences. The purpose of this test was to determine to what extent drawings in children ages two to thirteen are preconditioned by intellectual development. She believed that the emotional development of children is guided by maturation as opposed to environmental influences. These tests were unique because they were the first to devise an objective scoring method using drawings as a mental measurement. They were easily administered, and reliable, and the nonverbal nature of the test permitted it to be used in children from different nationalities, including deaf children. Goodenough summarized the purpose, design, and benefits of the test:

> The experiment under consideration had as its object the study of the intellectual factors involved in the spontaneous drawing of young children, and it has involved the construction of a scale to be used in the measurement of these factors. This scale is based on drawings of the human figure. As finally developed, the scale consists of fifty-one points, or unit of measurement. The points were derived by means of (a) the observations of differences which appeared to be characteristic of the performances of children at successive ages or school grades; (b) the formulation of objective definitions or descriptions of these differences; and (c) their statistical validation based on a comparison between the performance of children of different ages, and also between the performance of children who were accelerated in school and those who were retarded. (…) [t]he results obtained indicate that it forms a serviceable test of intellectual development, which is useful both for making comparisons between groups, and as a supplement to the usual type of intelligence test in the study of individual cases (24, p. 81). (…) It is believed that the test throws considerable light on the development of conceptual thinking in young children (24, p. 82).

Thus, the test is helpful to determine relationships and reasoning skills among different children ages three to fifteen. Dale B. Harris, in collaboration with Goodenough, revised the Goodenough Draw-a-Man Test in their book titled *Children's Drawings as Measures of Intellectual Maturity* in 1963, completed posthumously of Goodenough's death. One of Harris's goals was to provide a comprehensive review of the literature on children's drawings. Harris, provides a tribute to Goodenough's prior work and intended goals of this work:

> The project originally was undertaken collaboratively with Dr. Florence L. Goodenough, as a revision of her well-known scale. Her illness prevented active collaboration, but her interest was always keen. The present book has sought to accomplish several goals: to put in order certain uncompleted aspects of the Goodenough research, and to extend the knowledge of the psychology of children's drawings through certain original researchers. In the process of these researches, including the revision and attempted extension of the original scale, the author's respect for this brief test of intellectual maturity steadily increased, as did the author's respect for the validity of Dr. Goodenough's original ideas. Dr. Goodenough outlined the true scope of the problem and delineated essential dimensions in 1926, in her short but insightful book. The present work has built onto, but not substantively changed, the insights of that work (18, p. vii).

Although not named as a co-author on this work, Elizabeth S. Harris's contributions were acknowledged in the preface:

> Elizabeth S. Harris made considerable contributions to the research and to the preparation of the manuscript. At a time when the author's professional duties were particularly pressing, she relieved him of work with the proofs. This assistance is gratefully appreciated (18, p. viii).

In recognition of their collaborative contributions to the revisions of the test, it was renamed in 1963 the Goodenough-Harris Drawing Test (GHDT) (25). The current revised version of the GHDT has been touted as easy to administer, highly reliable, enjoyable, and a good measure of general intelligence. It is best suited to be used in children less than twelve years of age (26).

McCall-Crabbs Test Lessons in Reading

There is limited historical information available on Lelah Mae Crabbs (Schroeder) (1885–1980) who was born in Toledo, Lucas Co., Ohio (27). At the time of preparation of the test, *Standard Test Lessons in Reading* (1925), William Anderson McCall (1891–1982) was Associate Professor of Education and Lelah Mae Crabbs Lecturer in Elementary Education at the Teachers College at Columbia University (28). She also published the book *Measuring Efficiency in Supervision and Teaching* that same year, representing her thesis for a Doctor of Philosophy degree (29). She accepted a position as faculty at the University of California, Southern Branch, teaching two courses during the summer session involving measurement and experimenta-

tion in pre-school and primary education in 1926 (28).

The McCall-Crabbs Test (MCT) Lessons in Reading was designed to test and monitor silent reading speed and comprehension in children from grades second to eighth. The original test consisted of five books that contained practice lessons for grades second to seventh (30-35). The MCT represents a method to teach reading comprehension in grades third to eighth. The goals of the standard test lessons are designed to teach students how to "read under the control of their purposes and with a thoroughness appropriate to the purposes in mind" and to prepare a student to:

> 1. Teach them how to comprehend rapidly all kinds of reading materials; 2. Help them enjoy their reading lesson; 3. Make it easier for them to learn their other lessons; 4. Test and teach them at the same time; 5. Test them with a standard test; 6. Automatically indicate their proper grade classification in reading; 7. Teach them how to read carefully and accurately; 8. Teach them how to read the main points, to judge the relative importance of the various ideas presented, to follow the sequence or thread of thought, to reorganize material in order to answer questions that cut across this thread of thought; 9. Teach them how to read as rapidly as they can understand what they read, and to regulate their speed according to the purpose for which the reading is being done; 10. Teach them how to skim; 11. Enable them to score their own or each other's tests; 12. Motivate and improve their oral expression; 13. Provide them with opportunity for the practice of leadership; 14. Help prevent the dull pupils from becoming discouraged and the bright pupils from loafing; 15. Make it possible for them to appreciate more difficult literature, and literature of a wider range; 15. Increase their joy in literature by reserving the appreciation period primarily for appreciation; 16. Save their time. (32, p. 5-8).

McCall and Crabbs recognized the limitation of the Test Lessons in reading and the need for teachers to incorporate other aspects of reading into the lesson sessions, including speed reading, interpretation of what is read, emotional appreciation of the literature; differentiate good from poor material; skills in reading the index and table of contents; and reading strategies (e.g., methods of reading including exhaustively, hastily, or for main thought only). Because revised norms and academic standards for reading have changed since this test was originally published, results should not be used to correlate with grade levels. Nevertheless, some educators find that this test remains helpful for assessing and improving reading skills.

Kuhlmann-Anderson Tests

Rose Gustava Anderson (1893–1978) was born in Gothenburg, Nebraska, and received her doctorate from Columbia University in 1925 based on her thesis titled *A Critical Examination of Test-Scoring Methods* (17,25,36,37). She served as chief psychologist at the Minneapolis Child Guidance Clinic for the Minneapolis Board of Education from 1925 to 1929 (38). This position was followed by an appointment as director and psychologist at the Educational Adjustment Bureau of the Westchester County Children's Association in Westchester, New York, from 1930 to 1932 (17,37). She worked at the Psychological Service Center beginning in 1932, served as director of the Children's Division and Consultant to Women from 1942 to 1957, and was Vice-President of the Psychological Corporation from 1942 to 1955 (17,25,37,38). Anderson was a fellow and appointed council representative and President of the American Psychological Association (17,25,38).

Frederick Kuhlmann (1876–1941) collaborated with Rose Anderson and published the first edition of the group intelligence test in 1927. The test contained 35 tests designed to measure and differentiate levels of mental development by assessing their cognitive skills among school-aged children and young people (kindergarten to twelfth grades) to determine their potential and capacities for learning. In essence, it was a method to assess an individual's academic potential. Rose Anderson spoke about her collaboration with Dr. Kuhlmann:

> In 1919, it was the writer's privilege to become associated with Dr. Kuhlmann and to assume major initiative for devising, adapting, and standardizing group tests of intelligence in accordance with principles of scale construction which had evolved from Dr. Kuhlmann's earlier experimental work. Thus began a period of active collaboration which extended to Dr. Kuhlmann's death, a regrettable loss to the psychological profession in 1941 (39, p. 5).

Through additions and revisions of tests, the second and fourth editions brought the total number of tests to 39. The fundamental character of the test remained unchanged through the fifth and sixth editions. Each test contains:

> [f]rom six to twenty-four items or trials. These thirty-nine tests are numbered and arranged generally in the order of difficulty that children have in passing half of the trials and no more. (…) The total scale is arranged in nine separate booklets, comprising nine test batteries, each with its own leaflet of instructions and a scoring key. All of the battery of booklets but two contain ten tests, so that each battery includes a few of the tests used in the battery for the next 6 higher level and a few used in the battery of the next lower level. The nine battery booklets, then, constitute overlapping segments of the total thirty-nine-test scale. The two batteries at the lowest level, K and A, contain twelve instead of ten tests-with the first two tests in each battery to be used for practice purposes and not scored (39, p. 7).

The Kuhlmann-Anderson test is no longer routinely used and replaced by other intelligence tests, including the Stanford-Binet and Weschler tests.

Myers-Briggs Type Indicator

Isabel (Briggs) Myers (1897–1980) was the daughter of Katherine Cook Briggs (1875–1968). Katherine Briggs' initial concepts were rooted in Jungian theory, and Isabel Myers application and formulation of Jung's theories on individual differences in human personalities led to the conceptualization of the test. The initial indicator (Form A) named for their name-

sake was based on their observations and insights of different typology patterns of personality. They recognized four typologies, including mediative types (Is), spontaneous types (EPs), executive types (RTJs), and social types (EFJs). They believed that this psychological instrument that identified human differences would be useful in terms of understanding group dynamics, job placement, vocational planning, education, leadership training, marriage counseling, personal development, and relationships. This concept was copyrighted in 1943 and published by the title Introduction to Type by the Educational Testing Service, Princeton, New Jersey, in 1962 exclusively for research purposes (40,41). She co-founded with Mary Hawley McCaulley (1920–2003) at the University of Florida, Gainesville, the Center for Application of Psychological Type (CAPT) in 1975, established to conduct further research on the Myers-Briggs Type Indicator (MBTI) (42). The indicator was taken over by Consulting Psychologists Press, which assisted in expanding the outreach of the test (currently the Myers-Briggs Company since 2018) in 1975. The test underwent multiple revisions up to its current form in 2019 (MBTI Step I and Step II assessment (43). Isabel Myers published *Gifts Differing: Understanding Personality Type* with her son Peters B. Myers in 1982. In the preface, Peter Myers wrote:

> The premise of this book is that each of us has a set of gifts, a set of mental tools that we have become comfortable using and thus reach for in the everyday business of living. Although we all have access to the same basic tools in our psychological toolbox, each of us is more comfortable with and thus prefer a particular tool (or set of tools) for a particular task. It is our unique set of these preferences that gives us our distinct personality and makes us appear similar or dissimilar to others (44, p. xii).

Isabel Myers character as described by her grandchildren:

> Isabel made understanding patterns of type preferences her life's work: the differences and similarities between people. That's what drove her—systematically exploring patterns in how individuals make sense of, and reach judgments about, the world. One of her original motivations in the early 1940s was fighting the intolerance of differences among people that led to the atrocities of WWII. She repeatedly shared her hope with us that her work could prevent the occurrence of similar events. She believed that by understanding our own strengths and weaknesses, and those of others, we could develop our own potential and better understand and respect others. It was an all-consuming task that she finished on her deathbed with her book *Gifts Differing*. She was a gentle soul who herself fought against sexist assumptions about her over many decades to realize her vision. She believed deeply in the potential of all human beings, and the MBTI assessment reflects that belief (45).

The MBTI defines a model of personality. It is composed of four indicators or psychological functions in which one of these describes a person's source of energy (extrovert or introvert [EI]), the way they process information (sensing or intuitive [SN]), their approach to decision making (thinking or feeling [TF]), and requirement for structure (judging or perceptive [JP]). There is a separate scoring sheet for T and F for males and females. Scoring an indicator:

> [p]roduces four "preference scores" one for each of the four indices: EI, SN, TF, and JP. Each score consists of a letter showing the direction of that preference, followed by a number showing its strength. A person's four preferences make his type. (…) The letters showing the direction of each preference should be entered first. The points of E are compared with the points for I. Whichever letter of the two has the more points is written on the top line, opposite E and I. And similarly for SN, TF, and JP, as shown in the sample Scoring Box (46).

Thus, based on this concept, people are classified into eight personality typologies and sixteen personality types. The indicator is dynamic and thus may change over time. It is best conceptualized as a preference for seeing yourself and interacting with the external and internal world. There is a lack of compelling evidence that the test can classify people into eight Jungian typologies. The indicator as a scientific tool is unreliable, lacks sufficient validity, predictability, and utility in purporting what it claims (26,47,48).

Thurstone Test of Mental Alertness

Thelma Gwinn Thurstone (1897–1993) was born in Hume, Missouri, and received her doctorate from the University of Chicago in 1926 (49-51). She was a test editor at the American Council of Education (ACE) from 1923 to 1948 and developed in collaboration with her spouse new editions of the Psychological Examinations for College Freshmen and for High School Students (grades nineth to twelfth) in 1933 (49,52).

She served as a psychology instructor at the Chicago Teachers College from 1938 to 1942 (51,52). One of their more significant contributions to psychometrics was mathematical modeling, the concept of factor analysis to intelligence testing. This model distinguished within a dataset, constructs or factors among observed variables in order to better understand their interrelationship. She published *Factorial Studies of Intelligence* in collaboration with her husband Louis Leon Thurstone (1887–1955) in 1941 (53). She was a Research Associate at the University of Chicago from 1942 to 1952 and collaborated with Robert K. Burns and Lyle Spenser, establishing the Science Research Associates in Chicago in 1946 (49). She was Director of the Division of Child Study of the Chicago Public Schools from 1948 to 1952 (49,51). At the time of the publication of the third edition of the *Thurstone Test of Mental Alertness* in 1952, Thelma Thurstone served as Professor in the School of Education at the University of North Carolina (due to nepotism policies) until her retirement in 1968 and directed the Psychometric Laboratory from 1955 to 1957 (49,51). At the Frank Porter Graham Child Development Institute, she served as an education adviser, science research associate, and project director from 1970 to 1984 (17,49). She was the recipient of an honorary degree from the University of North Carolina Board

of Trustees in 1979 (54).

Her research areas focused on theory, measuring mental abilities, and constructing instructional curricula for children (51). In addition to the *Thurstone Test of Mental Alertness*, she authored with her husband *ACE Education Psychological Examinations for College Freshman and High School Students (grades nineth to twelfth)*. The Thurstone's also jointly authored *The Chicago Test of Primary Mental Abilities* in 1943 (the first version in 1938 authored alone by L.L. Thurstone), *Science Research Associates (SRA) Primary Mental Abilities Tests* in 1946, and SRA Tests of Education and Abilities from 1957-1969, the latter two years posthumously of the death of L.L. Thurstone (49,52,55-58). In addition to the collaborative work with her spouse, Thelma Thurstone developed the *Learning to Think Series*, first published in 1947, and *Reading for Understanding* published in 1958 (59,60).

L.L. Thurstone spoke of the depth of Thelma's contributions to their work:

> Thelma has the outstanding achievement in our family in managing an active household at the same time that she was professionally active. She has been a partner in every research project in the Psychometric Laboratory. For many years she was in the laboratory daily, helping to plan the projects, supervising most of the test construction, and participating especially in the psychological interpretation of results. In 1948 she left this work to become director of the Division of Child Study in the Chicago Public Schools. This report should really have been written as a biography for both of us (61, p. 321).

L.L. Thurstone and Thelma Gwinn Thurstone published in 1952 their *Test of Mental Alertness*. The purpose of the test as explained by the Thurstone's:

> [i]s a tool for the employer, personnel specialist, guidance counselor, or teacher who is seeking answers to such questions as: "How quickly will a new employee learn his job?", "How good are the employee's or student's qualification for learning new materials or new procedures?", "What is the student's or employee's capacity for understanding complex or subtle relationships?". In brief, the *Thurstone Test of Mental Alertness* is designed to measure an individual's capacity for acquiring new knowledge and skills (62).

The Thurstone test was designed to determine learning capacity among people and continues to be used in business and industry for work placement and to identify those individuals who possess the potential for advancement and success in several types of positions. Those with higher scores and hence "mental alertness" learn more rapidly, understand, and possess the resources and capacity to draw from and to discriminate between more complex and subtle relationships. These individuals are more adaptable and can shift more rapidly when faced with new situations. Those in the lowest tier can perform well on simple repetitive tasks and a series of duties. These people tend to take longer to learn their job requiring more explanation and guidance initially. They should be considered a beneficial addition to the workforce as they can serve as productive and cooperative employees.

The Thurstone's made significant contributions to the field of psychology and psychometrics. Thelma Thurstone was an outstanding figure in the field of psychology in her own right. Their work on multiple factor analysis remains the cornerstone in psychometrics today, particularly in its application of the study of personality and intelligence.

Cattell Infant Intelligence Scale

Psyche Cattell (1893–1989) was born in Garrison, New York. She was the first woman to receive her doctorate in Education from Harvard University in 1927, followed by continued studies in Vienna in 1930 (25,50,52,63,64). She served in the psycho-educational clinic as a research fellow contributing to the Harvard Growth Study and Harvard's Center for Research in Child Health and Development at the Harvard University School of Education and School of Public Health from 1932 to 1939 (52,63-65) and as an instructor at the Nursery Training School from 1936 to 1938 (63,64). Cattell was a chief psychologist at the Lancaster Guidance Clinic from 1939 to 1963 and at the Lebanon County Mental Health Clinic in Lebanon, Pennsylvania, from 1939 to 1942 (65). She established the West End Nursery School and Kindergarten, and served as its director from 1941 to 1974 (renamed Cattell School in 1945) (25,50,52,64,65). During her retirement, she published in 1972 the book, *Raising Children with Love and Limits* and a column titled "Children under eight" for the Lancaster Guidance Clinic (66). Her life's work involved children's education.

The Measurement of Intelligence of Infants and Children by Psyche Cattell was first published in 1940 and revised in 1960, based on work completed as a research fellow at the Harvard School of Public Health. The impetus for creating the developmental and intellectual scale for infants and toddlers (three to thirty months) emerged while studying normal development and intelligence as part of the Normal Child Series Study at the Center for Research in Child Health and Development in the Department of Child Hygiene at the School of Public Health, Harvard University:

> When the writer was called upon to select psychological tests to be applied at repeated examinations to the children enrolled in this series, the construction of a new test was not considered. It was only after using the then existing tests for several years that it became evident that they could be improved with the aid of the data that had already been collected. The construction of a new scale was then planned (67, p. 14).

The Gesell test (three-eighteen months), Minnesota Preschool Scale (twenty-four and thirty months), and Merrill-Palmar Scale (three years) tests were used during the first three years within the Normal Child Series Study prior to the development of this test. In the fourth year, the Developmental and Intellectual scale was used for ages three-thirty months, and revised Stanford-Binet (Form L) was substituted at three years (67). Cattell recognized limitations with the current infant test (e.g., lack of objective procedures for administering

and scoring items, lack of clear and precise directions; inclusion of personal-social items and development of motor control; no scaling; early age with unequal item distribution and poor standardization of which she accounted and attempted to minimize to the extent possible in the current test design (67). Thus, the construction of the test was designed to mitigate, to the extent possible, limitations identified in the previous test. In the words of Cattell, test development involved the following:

> [G]esell tests were used as a point from which to build. The items of the Gesell test were first arranged in an age scale similar to that of the Stanford-Binet tests. In order to make the scale as much an intelligence scale as possible, over 100 items, the responses to which were thought to be unduly influenced by home training or to dependent mainly on large muscular control, were eliminated. Other items collected from various sources were added to fill the gaps. All the directions for giving and scoring items have been rewritten in a detailed and in as objective a manner as possible. A large majority of the items taken from the Gesell test were modified, more or less, in order to make the giving or scoring more objective, or to increase or decrease the difficulty for the purpose of attaining an equal number of items at each of the age levels covered (67, p. 23).

For the most part, the Cattell Infant Intelligence Scale has been replaced by the Bayley test and is preferred by some because of its ability to identify children with IQ scores less than 50, the cutoff for the Bayley test (15).

Crawford Small Parts Dexterity Test

We were unable to identify any historical information on Dorothea M. Crawford. She published several books with her husband John Edmund Crawford (1904–1971) beginning in 1954, including *Milestones for Modern Teens* in 1954, *More Power to You* in 1957, *P.S. to Puzzled Parents* in 1959, *Go for Courage* in 1961, and *Better Ways of Growing Up: Psychology for Teenagers* in 1964 (68-72). The *Crawford Small Parts Dexterity Test* was initially published with her husband John Edmund Crawford in 1956 (73). According to the manual:

> The Small Parts Dexterity Test is a performance test of fine eye-hand coordination, used for personnel selection and guidance. It involves tweezer dexterity with small pins and collars, and starting and tightening small screws with a screwdriver. The revised manual gives percentile norms based on some thousands of employees, applicants, and students (73, p. 359).

Although this test may help identify specific tasks, it lacks sufficient validity to serve as a general tool for measuring dexterity (26).

Gilmore Oral Reading Test

Eunice (Crocker) Gilmore (1915–1998) was born in Rochester, New York, studied music in Paris with Nadia Boulanger (1887–1979), and was a music teacher at Longy School of Music, Shady Hill School, and Radcliff College (1942 to 1943), Cambridge, Massachusetts (74). She received her doctorate in musicology on "canzona", a lyrical and vocal form of Italian instrumental music, from Harvard University in 1943 based on her dissertation titled "An Introductory Study of the Italian Canzona for Instrumental Ensembles" and wrote the entries on canzona for the Harvard Dictionary of Music in 1944 (75). The Gilmore's founded the Gilmore Institute in Boston, Massachusetts, and published three books, including the *Gilmore Oral Reading Test, A More Productive Child: Guidelines for Parents* in 1978, and *Give Your Child a Future* in 1980 (76,77).

The Gilmore Oral Reading Test was initially published in 1951 by John V. Gilmore with Eunice Crocker Gilmore's name appearing on the 1968 version. The test was developed to provide educators a method to assess an individual's oral reading performance (reading speed, accuracy, and comprehension of material read) for students in the first through eighth grades. The test was structured as follows:

> There are two equivalent forms, A and B. Each comprises ten carefully constructed oral reading paragraphs which form a continuous story, and an illustration of characters and events in the paragraphs. There are five comprehension questions for each paragraph. Although administration time will vary somewhat with the grade and reading level of the pupil, in most instances 15-20 minutes will be required. The errors made in reading the paragraphs, the time required for reading each paragraph, and responses to the comprehension questions are recorded, at the time of testing, in each pupil's Record Blank (78, p. 1). (…) The most important aspect of the construction of the test was the gradation of the difficulty of the paragraphs. The three variables considered here were vocabulary, sentence structure, and interest (78, p. 2).

In constructing the test, the ten paragraphs tell a continuous narrative story dealing with different episodes within the life of a family. As the story progresses, the paragraphs become more advanced based on the level of reading difficulty. An accompanying illustration precedes each section portraying the characters in the story. The illustrations are intended to spark interest within the reader and for the test to resemble a reading a book (78). This test is no longer in commercial use.

Griffiths Mental Development Scale

Ruth Florence Griffiths (1895–1973) was born in London, England (79). Her educational timeline is unclear. We are unable to confirm unequivocally the date or location of when she received her doctorate. She received additional academic training at Somerville College, Oxford, and London University, England, under the aegis of John Carl Flügel on imagining and dreams in children as part of a child's emotional, mental, and intellectual development, which led to the publication of her book *A Study of Imagination in Early Childhood* in 1935 (80,81). She served as a principal psychologist at St. George's Hospital, Hyde Park Corner, London, England, from 1933 to 1948; and as a psychologist at Burden Mental Research Trust at Stoke Park, Bristol, England, from 1938 to 1944; Somerset County Education Committee from 1946 to 1951; and at Har-

ley Street, London. She co-founded along with Rose Unmack and Brian Henry Burne and served as Director of the Association for Research in Infant and Child Development (ARCID) in 1957 (79,81). She was the recipient of the Order of the British Empire Award in recognition of her contributions to child psychiatry. The Worcester State College in Worcester, Massachusetts, has a named endowed scholarship in her honor in support of a student who "demonstrates a commitment to the advancement of children and the teaching profession" (82).

Griffiths published in 1954 a mental development scale for testing infants below two years of age to assess their intelligence or mental growth. According to Griffiths, the work was:

> [b]ased upon extensive research that has its origins in work among mentally handicapped persons in the years before the war. From this I built up my own provisional Scale of Tests, based partly on the needs of mentally defective persons and partly on tests and observations of normal children of the younger ages. The work was for years incidental to other activities, but during the war it was stimulated by my experience as a psychologist working among evacuated children. It was not until after the war that I found opportunity to standardize this first part of my scale on a population of normal babies (83, p. v).

Griffiths's work involved developing a new testing technique and novel scale for measuring intelligence or assessing degrees of disabilities in infants. The methods involved in creating this test:

> [e]xtended over several years and has involved a detail study of the mental development of several hundred babies, ranging in age from two weeks to twenty-four months. Tentative norms of development have been established over a wide range of activities. From these the new scale of test has been derived. Moreover, a new diagnostic technique (differential diagnosis of mental status), for studying development in special cases, has become possible. This method is demonstrated by means of "profiles" (83, p. 2).

The Griffiths Mental Development Scale (GMDS) was revised in 1970 with an extended revised scale for older children up to eight years of age added in 1996 (84,85). A redesigned version of the GMDS was made by Elizabeth Green et al. in 2016 and renamed Griffiths III, Griffiths Scale of Child Development third edition. The test is used in children from birth to six years of age (86).

The Neale Analysis of Reading Ability

Marie Draga Neale (Pasalich) (1922–2011) was born in Auckland, New Zealand (87). She served as Professor of Education at Monash University with a focus on *developmental psychology* and special education (88). She was the first female in Australia to be appointed to a new chair (State Council for Special Education) with a focus in the areas of *developmental psychology* and special education and served on the National Literature Board of Review (88). She served as faculty at Monash University, Victoria, Australia during the time of her 1986 publication on the revised version of reading ability (89). Neale was awarded the Order of the British Empire in 1979 with the accommodation "For service to education, particularly for children with special exceptional needs." (90,91). A description of her character as described as a tribute to her life:

> Marie was a true pioneer, trailblazer, setting her own course into uncharted waters; explored them and was hugely successful. She made things happen that others hadn't dreamt of, both professionally and for her blessed family. Her light was not just a spark but a burning fire that touched and transformed countless other souls (92).

The *Neale Analysis of Reading Ability* was first published in 1958 and revised in 1984. The title rightfully described the goals of the test to identify those children at risk that require remediation. As summarized by Neale:

> The emphasis of the Analysis was to move from a piecemeal approach to reading difficulties, to a more comprehensive view of the child's personality and performance. (…) Accordingly, its style of assessment of reading emphasised a positive interaction between the examiner and the child. Its systematic categorisation of errors and difficulties encountered by the child when reading provided for a broader, more flexible style of appraising children's reading. The title given to the instrument sums up the break with an older philosophy of testing, and highlights the role of an "analysis" in making an informed, sensitive examination of an individual for subsequent tutoring (89, p. 346). The analysis consists of six graded passages of prose for children 5 to 11 years arranged as a "continuous" reading scale. After the oral reading of each passage, comprehension questions are asked to assess the readers' ability of their "understanding of the main idea of the narrative, the sequence of events, details, and the ability to make some limited inferences" (89, p. 347).

The third version of *Neale Analysis of Reading Ability* published in 1999 is commercially available and remains in use (93).

Gates-McKillop-Horowitz Reading Diagnostic Test

Anne McKillop (Anne Selley) (1918–1998) joined the Psychological Foundation at Columbia University in 1945. Her research interest and life's work focused on remedial reading in elementary school and child development (94). She co-authored with Harold Florian Clark *An Introduction to Education* in 1951 and published the book *The Relationship Between the Reader's Attitude and Certain Types of Reading Response* in 1952 while serving as an instructor at the Psychological Foundation of Education, Teachers College, Columbia University (95,96).

The *Gates-McKillop Reading Diagnostic Test* was first published in 1962 (97). Arthur Irving Gates was Professor Emeritus of Education, and Anne S. McKillop was now Professor of Education. At the time of the publication of the second revised edition, the authors on the test also included Elizabeth Cliff Horowitz, Adjunct Assistant Professor of Education at the Teachers College, Columbia University, now renamed

Gates-McKillop-Horowitz Reading Diagnostic Test (98). The *Gates-McKillop-Horowitz Reading Diagnostic Test* represents a revision to the *Gates-McKillop Reading Diagnostic Test.*

The test is designed for children in grades one through six to assess their strengths and weakness in oral reading as well as reading sentences, words (flash and untimed), knowledge of word parts (syllabication, recognizing and blending common word parts, reading words, giving letter sounds, naming capital and lower-case letters), and recognizing the visual forms of sounds (vowels). The title of the test was aptly chosen as its goal is to identify the child's cause of the reading deficiency and not to compare the performance to other children of similar age. Thus, it is genuinely an individual test that also contains a subjective component. The focus is solely on the child's reading and writing skills as they are examined individually. The test as described in the first edition:

> [s]eeks answers to the question: What particular skills are underdeveloped and what skills are matured to a "normal" or superior degree? On the basis of these answers, a program of instruction can be planned. Careful observation of the child's methods of responding to and working with the test provides invaluable information, especially if note-taking and such aids as the checklist in the *Pupil Record Booklet* are consistently and skillfully employed. Study of the child's answers, the nature of the errors, and the patterns of the responses should become, with experience, more revealing and significant for diagnostic and remedial purposes than reliance upon numerical score and rating system alone. The test scores are merely a means of assisting the examiner to achieve a more comprehensive and valid understanding of each case (97, p. 2).

The *Gates-McKillop Reading Test* has been no longer in commercial use since 2016.

Slingerland Screening Test for Identifying Children with Specific Language Disability

Beth H. Slingerland (1900-1989) was born in Santa Rose, California, was a reading teacher from the 1920s to the 1930s and subsequently director of the Punahou School in Hawaii from 1938 to 1945. She served initially as a second-grade teacher, followed by a consultant for specific language disabilities in Renton, Washington, until 1965 (99-101). During this time, Slingerland helped dyslexic children and provided teachers training to assist children with this reading disorder in the classroom (101). She was instrumental in helping to develop the Renton Summer School Program led by the Seattle Pacific College starting in 1960 (101). In 1963, she served as a consultant to the Highland Park School and Texas Scottish Rite Hospital, Dallas, Texas, and Richardson School, Richardson, Texas. Two years later, she was appointed consultant to the Menlo Park California public schools (101). She trained teachers to assist children with language impairments by establishing a summer school in Menlo Park, Kalispell, Montana, and Medford, Oregon.

She founded the Slingerland Institute located in Bellevue, Washington, in 1977 (99). Slingerland was the recipient of the Sixth Annual Samuel T. Orton Award in 1972 (101). An endowment named the "Slingerland New Horizons" was established by Mr. Steele Stewart, one of her former students in her memory, with funds designated to train faculty who work with children with learning differences (102). The acknowledgement in her book provides a glimpse of Slingerland's character:

> Most of all my gratitude is extended to the many classroom teachers whose basic understanding and skill with the techniques have prevented failure for many and restored self-confidence and successful learning for others who were failing (103, p. ix). (…) Inspiration has come from working with and observing the wonderful SLD boys and girls themselves whose response is satisfying compensation for all the hours and effort and labor involved. Gratitude is extended to their parents, too, for all their encouragement, faith, and active support (103, p. x).

Slingerland recognized the role of the senses (hearing and seeing) and kinetic-motor integration development as a visual approach to reading and an auditory-kinesthetic function in oral and written spelling in children with specific language disabilities (SLD). She recalled, "Opportunity came to me in the mid-1930s to discover why bright children could not seem to respond to methods of teaching reading, spelling, and writing found successful with other children with equal or even of less intelligence" (103, p. ix). The goal was to identify early through screening children with specific language disabilities so that preventive measures and remedial education through special classrooms could be provided (101). Slingerland recognized that some children lack verbal and auditory-motor (kinetic) aspects of language while others struggle with the visual aspects of perception and recall of written symbols. The test as conceptualized by Slingerland:

> The teaching technique to be presented herein is for use as a preventive or early remedial measure with Specific Language Disability (SLD) or Specific Developmental Dyslexic children in the primary grades. Realizing the impossibility of giving individual instruction to most of the children in public school classroom situations, the technique was developed as a group therapy. It is an adaption for classroom use of the ORTON-GILLINGHAM approach to reading, writing, and spelling. Because language depends on an intersensory functioning, meaning a neurological organization for automatic linkage of auditory-visual-kinesthetic impression within the human brain, the underlying basic principles upon which this technique is organized is multi-sensory. The object is to foster simultaneous or automatic auditory-visual-kinesthetic (A-V-K) association, regardless of which modality carries the initial stimulus (103, p. xv).

The Slingerland screening test remains in commercial use.

Eysenck Personality Inventory

Sybil Bianca Giulietta Eysenck (1927–2020) was born Sybil Rostal in Vienna, Austria, and received her doctorate in 1955 under the aegis of Phillip Vernon, Professor of Educational

Psychology at the University of London Institute of Education, based on the thesis titled, A Dimensional Analysis of Mental Abnormality (50). Her work centered primarily on the study of personality traits and psychology in women (50). She served as an editor of the *Personality and Individual Differences Journal* (104).

Eysenck supported the concept of two factors or dimensions, extraversion-introversion (E) and neuroticism (emotionality or anxiety) (N)-stability which comprises the primary dimensions of personality. A variety of different traits and their variances defines the temperament of individuals. Eysenck proposed a biological basis for personality, recognizing hereditary aspects of E and N factors in which the autonomic nervous system regulates the N factor. In contrast, the E factor is controlled based on the degree of excitation and inhibition of the central nervous system. They postulated that the ascending reticular formation within the central nervous system regulates excitatory and inhibitory pathways. Thus, the outward expression of the extrovert and introvert constitutes the phenotype or behavioral aspect. At the same time, the degree of arousal or control of the N and E factors is influenced by genotype or constitutional aspects. As stated by Hans Jürgen Eysenck and Sybil Eysenck regarding the *Eysenck Personality Inventory* (EPI):

> Observable behavior is a function of these constitutional differences in interaction with the environment; this interaction gives rise to descriptive, phenotypic differences in extraversion-introversion, which can best be measured in terms of inventories such as the EPI. This differentiation between laboratory tests and the inventories as being more closely related to genotypic and phenotypic aspects of personality respectively is not, of course, an absolute one, but it may nevertheless be useful in thinking about the meaning of the results achieved with the use of the different types of measuring instruments (105, p. 5).

The Eysenck's published their personality inventory in 1963, a personality questionnaire in 1975, and a revised version of the psychoticism scale in 1985 named for their namesake. The *Eysenck Personality Questionnaire* published in 1975 represents a revised version of the EPI which incorporated a P or psychoticism scale (26).

The EPI was conceptually similar to the Maudsley Personality Inventory (MPI) in that it measured two major dimensions of personality, extraversion-introversion (E) and neuroticism-stability (N). However, the EPI was considered to be more pragmatic compared to the MPI based on the following aspects:

> (a) The EPI consists of two parallel forms, thus making possible retesting after experimental treatment without interference from memory factors. (b) The EPI items have been carefully reworded so as to make them understandable even by subjects of low intelligence and/or education; the MPI items were found to be rather too difficult with subjects of this type. (c) The correlation between extraversion and neuroticism on the MPI was small but nevertheless marginally significant; suitable item selection has caused it to disappear in the EPI. (d) The EPI contains a Lie Scale which may be used to identify subjects showing "desirability response set"; no such scale was contained in the published form of the MPI. (e) The retest reliability of the EPI is somewhat higher than that of the MPI; even after periods of several months it is still in excess of .85. f) Further, direct evidence is available of the validity of the EPI as a descriptive instrument of the behavioral manifestations of personality (105, p. 3).

The further revised version of the EPQ published in 1985 is in commercial use and represents a reliable and valid instrument for measuring extraversion, neuroticism, and psychoticism (106).

The Gray-Wheelwright Test

Jane (Hollister) Wheelwright (1905–2004) was born at Steffens Mansion, Sacramento, California, and married Joseph Balch Wheelwright (1906–1999) in 1929 (107). Both were Jungian analysts trained under Carl Gustav Jung (1875–1961), Marie-Louise von Franz (1915–1988), and Toni Wolff (1888–1953) in Zürich, Switzerland (108,109). They also lived in London, England, and Shanghai, China (107,109). Jane Wheelwright became accredited as an analyst, and the Wheelwrights served as founding members of the Jungian analytic group training, later renamed the C.G. Jung Institute of San Francisco (107,109-111). Her areas of interest were to better understand the relationship between wilderness and psyche and psychology and death (109). She authored the books *Death of a Woman* in 1981 and *The Ranch Papers: A California Memoir* in 1988 (110-112). As a description of her character reported by John Beebe:

> She was profoundly ahead of her time. She was saying in the 1950s that it was ridiculous to have any kind of prejudice against homosexuality. She worked very hard with lesbian patients. (…) She was unusual among Jungian for her practicality and for bringing what Beebe called a "very earthy, authentic female voice" to analytical psychology (107).

Her niece C. Doyle Hollister wrote:

> As one who had the privilege of knowing her, I can attest that Jane was a person of depth, intensity, intelligence, and originality, passionately engaging internal and external nature to the end (113, p. 31).

The *Gray-Wheelwright Test*, a personality survey first formulated in 1944 and introduced in 1946, was based on Carl Jung's psychological profile. Horace Gray (1887–1965) was an internal medicine physician and Jungian scholar and met the Wheelwrights at the Langley Porter Psychiatric Institute at University of California San Francisco (UCSF) (114). The basic principle behind the test was to "help people understand their relation to themselves and others" (115, p. 6). This test has undergone multiple revisions. It separates and assesses the general habitual attitudes (introversion and extraversion) as well as four paired function types which include the function of perception (sensation versus intuition) and function used

for assessing or judging capacity (thinking and feeling). When paired with the two functions of perception and judgment, the general attitudes result in profiling eight specific personality (psychological) variable types. There are eight variable types each for introversion and extroversion, resulting in sixteen variables.

The purpose of the *Gray-Wheelwright Test*, also referred to as the Jungian Type Survey, as stated in the 1964 fifteenth revision was to:

> [e]valuate, in an objective manner, one's habitual method of dealing with many of life's daily situation. It also measures the degree to which one is committed to such an adaptation by indicating the extent of introversion-extraversion, sensation as contrasted with intuition, and thinking as compared with feeling (115, p. 3). (…) [p]rovide a psychological type description of the person who fills out the questionnaire (115, p. 4).

Thus, the survey describes a person's psychological type. Furthermore, the survey is also unique in that it provides order in determining which function takes precedence over the other. The survey is self-administered with the 1964 revised version containing 82 items, seven more than the original 1944 version (115). Its function is "[t]o find which combination is dominant in an individual and further whether a perceiving or judging function is more readily used" (115, p. 4).

The Wheelwright's believed that knowledge of a person's psychological type facilitates discussion between the patient and therapist, allowing the therapist to better speak to and communicate with the patient. The other role this test has is identifying the source of marital relationships and discord, as understanding each partner's psychological type may foster better communication between partners.

John A. Buehler and Elizabeth Wilson Buehler served as collaborators and co-authors on the sixteenth revision (115). Further revision to the test were made by Robert Winer in 2006 and renamed The Gray-Wheelwright-Winer 4-letter type indicator test (116).

The Beery-Buktenica Developmental Test of Visual-Motor Integration

Natasha A. Beery, daughter of Keith Edmond Beery, received her master's degree in Linguistics from the University of California, Berkeley in 1988 (117,118). She served as a staff research associate at the University of California San Francisco Medical Center for AIDS Prevention Studies from 1988 to 1995, qualitative research consultant at the Stanford Center for Biomedical Ethics from 1995 to 1997, and Co-Director at the Neighborhood Parents Network from 1997 to 1999 (117,118). Beery served as a Communication Consultant at Windrush School from 2006 to 2008, Presidents Parent Teacher Student Association (PTSA) at Berkeley High School from 2009 to 2012, and Senior Research Consultant at Kaiser Permanente, California from 2010 to 2012 (117,118). She currently serves as Director of Berkeley School Excellence Program (BSEP) and Community Relations at Berkeley Unified School District beginning in 2012 (117,118).

During his internship in a psychiatric child-guidance clinic, Keith Edmond Beery (1932–2010). identified the relationship between a child's ability to copy a geometric form and academic achievement. He recognized that the existing form-copying tests (e.g., Bender-Gestalt, Gesell, Griffiths, Starr) did not contain forms, arranged from simple to complex, reflecting normal child development (83,119,120):

> Thus in 1961, the VMI author began a series of experimental and empirical efforts to identify such a sequence of forms (121, p. 10). (…) *The Developmental Test of Visual-Motor Integration*, or VMI, is a developmental sequence of 24 geometric forms to be copied with paper and pencil. The primary purpose of the VMI is to help prevent learning and behavioral problems through early screening identification. The VMI can be either group or individually administered in about 10 to 15 minutes and can be used with preschool children through adults. First published in 1967, the VMI is used for and enjoyed by children throughout the United States and in other countries (121, p. 8).

The Developmental Test of Visual-Motor Integration (VMI) was initially published in 1967 by Keith Beery. Norman A. Buktenica and Natasha A. Beery names first appeared in the fourth edition of the test in 1997 (122). Beginning in 2003, she was involved in the revision of the Beery VMI test manual. The Beery-Buktenica is currently in its sixth edition and is used primarily for assessing and identifying deficiencies in visual-motor skills during childhood. Additionally, an adult form has been included for ages 19 years and older.

Boehm Test of Basic Concepts

Ann E. Boehm received her doctorate from Teachers College, Columbia University, in 1966. Throughout her career she remained on staff at the Teachers College serving as chair of the Department of Developmental and Educational Psychology and appointment professor emeritus of psychology and education in the Department of Health and Behavior Studies (123). Her primary areas of interest were children's literacy skills and concept acquisition (123). In addition to the *Boehm Test of Basic Concepts*, she authored with R.A. Weinberg *Classroom Observer: Developing Observation Skills in Early Childhood Settings and The Classroom Observer: A Guide for Developing Observations Skills* in 1997 and co-authored *Preschool Assessment Principles and Practices* with Maria R. Brassard in 2007 (124,125).

A scholarship has been named in her, and her husband's (Nelville Kaplan) honor at Teachers College named the Ann E. Boehm and Neville Kaplan School of Psychology Fund (126). The scholarship was established for a doctoral student interested in studying the psychological and educational aspects of children ages three to eight (126). In the word of Professor Margaret Jo Shepherd, a colleague of Boehm at her retirement, she spoke of the relationship that Boehm had with her students, "I could always count on your wisdom and intelligence and the nurturing you gave to your students" (127).

The *Boehm Test of Basic Concepts* was initially published in 1971 and has undergone two revisions - in 1986 and 2001. The basic concepts represent relational ones, which involve words that describe people or objects, spatial relationships, and quantity. They are cited as essential or "basic" concepts for students to master in order to perform successfully in reading, mathematics, and understanding the verbal instructions and lessons taught in the classroom. The test consists of fifty items or relational concepts that second-grade students should have mastered or nearly mastered. Thus, the test is designed for children in kindergarten, first, and second grade.

The Boehm test is used for instructional screening and planning ongoing interventions, identifying readiness and those at risk for learning difficulties, and as a research tool. As described by Boehm:

> Basic concepts are essential thinking tools. They are used at different levels of abstraction to compare, categorize, and to solve complex problems. Students need to understand basic concepts to: understand and describe relationships between and among objects; understand the locations and characteristics of persons, places and things; understand the order of events; follow teachers directions; follow instructions in the curriculum areas of language arts, mathematics, and science; follow teacher-made and standardized test instructions; and engage in problem-solving activities that involve classifying, sequencing, comparing, and identifying multiple attributes (128, p. 3).

A preschool version of Boehm's test is used in children ages three to five years and was published in 1986 (129). Both tests remain in commercial use and are helpful tools used in clinical psychological practice.

Bayley Scales of Infant Development

Nancy Bayley (1899–1994) was born in The Dalles, Oregon, and received her doctorate from the State University of Iowa (currently University of Iowa) in 1926 (17,130-132). She was on staff as an instructor in psychology at the University of Wyoming from 1926 to 1928 and at the University of California, Berkeley Institute of Child Welfare (currently Institute of Human Development) from 1928 to 1954 (17,50,130,132-134). During this time, Bayley held a concurrent research appointment at Stanford University in the departments of psychology and anatomy, and at Berkeley, as an instructor in Psychology, teaching a course on the assessment of infants and young children (135). At the University of California, she initiated the Berkeley Health Study in 1928, designed to study mental abilities beginning at twenty-one months following subjects for thirty-six years (25,134). Bayley's work focused on physical growth, motor abilities, and mental development as markers of human maturation led to a better understanding of the ability to predict adult height and rate of skeletal growth based on various physical characteristics and the influence of early mental function on later intelligence and environmental and hereditary variables (e.g., social class, parental education) on children's intelligence (134).

She served as chief at the National Institute of Mental Health Bethesda, Maryland, in the section of Child Development for ten years beginning in 1954. Bayley returned to the University of California and Institute, now named the Institute of Human Development, in 1964, where she participated in the National Collaborative Perinatal Project and served as an administrator at the Harold E. Jones Child Study Center (also formerly Institute of Child Welfare) (17,50,131,133). From 1968 until her retirement, as an emerita research psychologist at the Institute of Human Development, she was a consulting psychologist at the Sonoma State Hospital in California (17,50).

Bayley served as President of the Western Psychological Association (WPA) from 1953 to 1954, American Psychological Association Division 7 from 1953 to 1954, Division 20 from 1957 to 1958, and Society of Research in Child Development from 1961 to 1963 (50,130). She is the recipient of several awards and accolades including, the Distinguished Scientific Contribution Award (DSC Award) in 1966 (17). WPA Division 7 G. Stanley Hall Award in 1971 for her contributions in child development, the American Psychological Foundation Gold Medal in 1982, and the 1983 Distinguished Scientific Contribution (DSC) Award from the Society for Research in Child Development, among others (50).

To provide insights into Bayley's accomplishments and character, the citation on the 1966 DSC award read:

> For the enterprise, pertinacity, and insight with which she has studied human growth over long segments of the life cycle. With consummate skill in the use of available but imperfect instruments and with respect and sensitiveness for her subjects, she has rigorously recorded their physical, intellectual, emotional, and social development from birth to middle life. Her studies have enriched psychology with enduring contributions to the measurement and meaning of intelligence, and she traced important strands in the skein of factors involved in psychological development. Her participation in a number of major programs of developmental research is a paradigm of the conjoint efforts which are essential in a field whose problems span the generations (130, p. 1190-1191).

Bayley's contributions recognized internationally were instrumental in establishing techniques for assessing and measuring infant and child cognitive, intellectual, and psychomotor development (134,135). The Bayley Scale of Infant Development (BSID) was designed to test an infant's development or abilities during the first two and a half years of life. The final form consisted of mental scale, motor scale, and infant behavioral record. The mental construct evaluates cognitive abilities, including sensory-perception, discrimination, memory, learning, problem-solving, verbal communication, and abstract thinking. Motor skills include those which involve body control, coordination, and fine motor skills. Behavior involves the relationship; between the infant and the environment expressed through attitudes, interests, emotions, energy, activities, and response to stimulation (approaching or withdrawing) (136).

The final form was the cumulation of work requiring extensive revisions and additions to scales developed but no longer in commercial use (California First-Year Mental Scale in 1933, The California Preschool Mental Scale in 1934 on mental and motor development in infants and preschool-aged children and the California Infant Scale of Motor Development in 1936). This work culminated in developing a 1960 version (referred to as the 1958-1960 version) of the test (137-139). The 1969 version of the infant scale (representing three prior instruments) contained 163 items on the mental scale and 81 items on the motor scale (130). Bayley work was based on the recognition of the need to fill the gap found in current tests at that time on infant development:

> Many of the scales of infant development currently in use are based on tests and observation made twenty to forty years ago of small samples of youngsters, limited in geographic and socioeconomic distribution. There is clearly a need for more modern scales which take into account recent theoretical contributions dealing with the nature of early childhood development and which have norms based on improved sampling methods. The Bayley Scales of Infant Development (BSID) are designed to meet this need (136, p. 1).

The BSID underwent another revision in 1993 and was renamed the Bayley II (140). According to Aylward, the BSID is considered the most effective method for assessing infant development, having replaced the Cattell infant test (15). The test remains a useful tool for assessing infant development with the caveat that it does not correlate with later intelligence (26).

Goldman-Fristoe Test of Articulation

Macalyne Watkins Fristoe (1931–) was born in Nashville, Tennessee, received her doctorate from Vanderbilt University in 1972, and served on faculty in the Departments of Audiology and Speech and Psychology (141,142). She was appointed speech clinician at East Tennessee Hearing and Speech Center Knoxville, Tennessee, from 1953 to 1954, and Nashville-Davidson County Public Schools cerebral palsy program Nashville from 1955 to 1957 (141,142). She was a speech clinician and assistant director at the Bill Wilkerson Hearing and Speech Center from 1955 to 1967 (142). She returned to Vanderbilt in 1960, where she was an instructor of speech pathology until 1967, followed by appointments as an instructor in psychology from 1971 to 1972 and assistant professor from 1972 to 1974 (142). She served in the Department of Communications Disorders at the University of Alabama, Birmingham, was appointed Associate Professor in the Department of Biocommunications, and directed the Language Interventions Study Project from 1974 to 1976 (141). At Purdue University, West Lafayette, Indiana, Fristoe served as director of the speech clinic from 1976 to 1979, Professor in the department of psychological science from 1982 to 1996, associate department head of the speech and audiology clinics from 1993 to 1996, and director of graduate programs in the Department of Audiology and Speech Sciences from 1986 to 1990 and 1992 to 1996 (141,142).

She was Vice-President of Communication Disorders Division from 1985 to 1986 and President of the Council for Exceptional Children (CEC) Division for Children with Communication Disorders from 1986 to 1987 (142). Fristoe also was a member of the advisory board for the Indiana Resource Center for autism from 1986 to 1994 (141,142). She was honored in 2016 as the recipient of the Association Award from the American Speech-Language-Hearing Association (ASHA).

At the time of the publication of the test Ronald Goldman (1934–2015) was an associate professor of speech pathology at Vanderbilt School of Medicine and Bill Wilkerson Hearing and Speech Center, the site where Macalyne Fristoe served as coordinator of Speech Pathology Services (143). The *Goldman-Fristoe Test*, the standard for pediatric speech assessment, was designed to identify articulation errors in consonant sounds. The test consists of three subsets, sounds in words, sounds in sentences, and stimulability, whose assessment involves the use of both imitative and spontaneous speech. The test was developed over four years and contained several unique features compared to other tests of articulation:

> 1) examine all of the necessary phonemes, 2) obtain an adequate and accurate sample of the subject's speech production under several conditions ranging from imitative to conversation, 3) be presented in a form that would be easy to administer, eliminating loose cards or objects as stimulus material, 4) be presented in a kit which would contain all materials needed for testing articulation and recording results in a convenient form, 5) be colorful and interesting to the subject, 6) be conducive to the minimizing of distraction and to the focusing of the subject's attention on the stimulus materials, 7) provide a form for recording responses which is easy to use and which facilitates a comparative evaluation of the subject's pattern or errors under the various test conditions (144).

This test is currently in its third edition and remains in clinical use in children to screen, track, and monitor articulation skills through young adulthood.

The Piers-Harris Children's Self Concept Scale

Ellen V. Piers (1919–2013) received her doctoral degree at George Peabody College for Teachers (merged with Vanderbilt University in 1979), Nashville, Tennessee, in 1954 (145). She was appointed faculty member as a psychologist at Pennsylvania State University in 1954 and Associate Professor in 1968 (145). She served as editor of the *Pennsylvania Psychological Association Newsletter* beginning in 1963 (145). An award in her name has been established at Acadia University, where she completed her undergraduate studies in 1939 and 1946 for fourth-year students advancing for graduate study in Clinical Psychology (146).

Her areas of research interest were devoted to the study of child development and behavior disorders (145). Ellen V. Piers and Dale B. Harris developed a self-concept scale with a final dichotomized questionnaire (yes or no) consisting of 80-items, designed for children as a research tool to assess the develop-

ment and correlates of attitudes about the way they feel about themselves (147). The test was designed primarily for research purposes with the following intent as summarized by Piers:

> The Piers-Harris Children's Self Concept Scale entitled, "The Way I Feel About Myself," is a quickly completed (15-20 minutes) self-report instrument designed for children over a wide age range. Administered in group form it requires approximately a third-grade reading knowledge. On an individual basis it may be used below that level. It can be administered and scored by responsible, educated non-psychologists, but should be interpreted only with the aid of someone knowledgeable in measurement and statistics, psychology of adjustment, and self-theory (147, p. 2).

Factor analysis identified that the questions were segregated into six variables: behavior, intellectual and school status, physical appearance and attributes, anxiety, popularity, and happiness and satisfaction (147). The third edition of the Piers-Harris Self-Concept Scale remains in clinical use.

Conclusion

Learning about the purpose of a psychometric test in the context of a biographical sketch provides a glimpse of a person's life contributions and accomplishments. Despite our intentions, there remain gaps in the literature about some of these women's life stories. With several notable exceptions (e.g., Myers-Briggs, Goodenough, Neale), it is difficult to know the extent of a woman's contribution to the test during this period. In the case of Thelma Thurstone, we began to appreciate even more of her talents later in life as an independent investigator. It is important to recognize the historical context and challenges women faced in academia and a field predominately dominated by men during this period when reading this review. The traditional societal roles that women played have, without question, changed dramatically over the years. Despite these obstacles, women made significant contributions and inroads into the field of psychometric testing and psychology for the sake of future generations.

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