

The background of the cover features a repeating pattern of leaves in various shades of blue and teal, with some leaves showing darker veins. The pattern is dense and covers the entire page.

THE ESSENTIALS OF

Testing AND Assessment

A Practical Guide to Counselors, Social Workers, and Psychologists

Edward S. Neukrug

3E

R. Charles Fawcett

Essentials of Testing and Assessment

A Practical Guide to Counselors,
Social Workers, and Psychologists

THIRD EDITION

Edward S. Neukrug
Old Dominion University

R. Charles Fawcett
Director, Region Ten Fluvanna Counseling Center



Australia • Brazil • Mexico • Singapore • United Kingdom • United States

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***Essentials of Testing and Assessment:
A Practical Guide to Counselors, Social
Workers, and Psychologists,
Third Edition***
Edward S. Neukrug and R. Charles Fawcett

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Product Manager: Julie Martinez
Content Coordinator: Sean Cronin
Product Assistant: Kyra Kane
Media Developer: Audrey Espy
Outsource Development Manager:
Jeremy Judson
Outsource Development Coordinator:
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To my father and my brother, the real math experts in the family.
—Ed Neukrug

To my loving wife Laura, who makes my life richer.
—Charlie Fawcett



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Preface



We have been delighted to update *Essentials of Testing and Assessment* to its third edition. We believe this new edition brings some important and critical changes, yet we have kept the basic content of the book as is. We hope that by obtaining good input from reviewers and by adding important and new issues that have arisen, the third edition adds value to the previous two editions. Despite the changes and additions, we were careful to keep the core of the book the same and to only cover what can reasonably be learned in a one-semester course on testing and assessment—not more. But don't let that fool you, as *Essentials of Testing and Assessment* includes quite a bit of information! We believe this book is written in a down-to-earth fashion that you will hopefully find interesting. In addition, we offer stories and vignettes that highlight learning. Some of the overarching changes include:

- *Rearranging the sections of the book.* Although the book has kept the basic content from the original 12 chapters, the chapters have been redistributed in the book to better suit classroom teaching and student learning (see description of chapters that follows).
- Inclusion of information on two national studies, one on counselors use of assessment instruments and one that focuses on the kinds of assessment instruments that are taught in counseling programs.
- Update of citations and research.
- Additional information on cross-cultural assessment.
- The addition of new and updated assessment instruments.
- Updating the chapter on diagnosis to reflect DSM-5.

The following gives a brief description of the content and the changes to the 3 sections and 12 chapters of *Essentials of Testing and Assessment*.

SECTION I: UNDERSTANDING THE ASSESSMENT PROCESS: HISTORY, ETHICAL AND PROFESSIONAL ISSUES, DIAGNOSIS, AND THE ASSESSMENT REPORT

Section I introduces the reader to a broad range of issues related to understanding testing and assessment. Chapter 1 provides definitions of assessment and the history of assessment, Chapter 2 provides the reader with important professional, ethical, and legal issues in assessment. Chapter 3 offers information on diagnosis, one critical aspect of the assessment process, whereas Chapter 4 presents information on how to write a test report.

Chapter 1: History of Testing and Assessment

Chapter 1 begins with a discussion of the differences between testing and assessment and then goes on to highlight the historical development of testing and assessment from ancient times to modern-day assessment instruments. Along the way, we discuss some of the people who were critical to the development of assessment measures and examine some of the many controversial issues that arose. The chapter nears its conclusion by reviewing the current categories of assessment instruments, including ability testing (achievement and aptitude testing), personality assessment, and informal assessment. We finish by raising a number of concerns that continue to face us as we administer assessment instruments. Some of the changes in this chapter include adding the following: additional examples of early types of assessment instruments, quick definitions of types of assessment procedures, and a figure that helps to understand the various kinds of ability, personality, and informal assessment procedures.

Chapter 2: Ethical, Legal, and Professional Issues in Assessment

Chapter 2 focuses on the complex ethical, legal, and professional issues that are faced by individuals who are assessing others. We begin by discussing the complexity of ethical decision making and then identify ethical codes and professional standards critical to testing and assessment. We go on to discuss the importance of wise ethical decision making, and we identify a number of laws that have been passed and lawsuits resolved that impinge on the use of tests in the assessment process. The chapter concludes with a discussion of professional associations that address assessment, a brief discussion of accrediting bodies that address assessment, an introduction to the growing field of forensic evaluation, the importance of viewing assessment as a holistic process, a discussion cross-cultural assessment, and the importance of embracing the testing and assessment process. Some changes to this chapter include updating information from revisions of ethical codes, updating and streamlining important assessment standards, updating relevant laws related to the administration and interpretation of tests, and expanding the discussion on cross-cultural issues related to assessment.

Chapter 3: Diagnosis in the Assessment Process

Chapter 3 (formerly Chapter 11) has been dramatically changed to reflect the transition from DSM-IV to DSM-5. This chapter starts with a discussion on the importance of making a diagnosis then goes on to offer a brief history of the *Diagnostic and Statistical Manual of Mental Disorders*. An overview of DSM-5 is then offered, which includes the change to a single axis system; the use of a dimensional assessment (mild, moderate, severe, and very severe); the use of wide spectrum disorders, brief explanations of the specific diagnostic categories; a description of how DSM-5 addresses cross-cultural issues; an explanation of how medical, psychosocial, and environmental conditions can impact diagnosis; and some examples of how to make a diagnosis.

Chapter 4: The Assessment Report Process: Interviewing the Client and Writing the Report

Chapter 4 (formerly Chapter 12) was moved to the first section of the book because it seemed to better fit the content of Chapters 1 and 2. Also, many faculty were having students write test reports; thus, we thought it would be best to highlight the test report-writing process near the beginning of the book so students would have an early understanding of how to begin this important project. However, since this chapter and Chapter 3 can stand on their own, you may want to continue to cover them later in the course. Chapter 4 begins with a definition of the purpose of the assessment report. Then, we discuss the importance of accurately identifying the breadth and depth of a client's issues so that one can make smart decisions in choosing which assessment procedures to use. In this chapter, we also distinguish between conducting a structured, unstructured, and semi-structured interview, and we point out how computers have become increasingly important in the writing of test reports. Finally, we give a detailed description of the categories of a test report and offer suggestions on how to write a report. Included in this description is an expanded explanation of the mental status exam and a new section on assessing lethality. Using a fictitious client, we offer an example of how to right a report. The resulting five-page assessment report can be found in its entirety in Appendix D of the book.

SECTION II: TEST WORTHINESS AND TEST STATISTICS

Section II of the book addresses test worthiness and test statistics. The three chapters that make up this section examine how tests are created, scored, and interpreted. These chapters all use test statistics in some manner to explain the concepts being presented. In this section, we demonstrate how collecting and interpreting test data is a deliberate and planned process that involves a scientific approach to the understanding of differences among people.

Chapter 5: Test Worthiness: Validity, Reliability, Practicality, and Cross-Cultural Fairness

Chapter 5 examines four critical areas of test worthiness: (1) *validity*: whether a test measures what it is supposed to measure; (2) *reliability*: whether the score an

individual receives on a test is an accurate measure of his or her true score; (3) *cross-cultural fairness*: whether the score the individual has obtained is a true reflection of the individual and not a function of cultural bias inherent in the test, and (4) *practicality*: whether it makes sense to use a test in a particular situation. After examining these four factors, we conclude with a discussion of five steps to use to assure test worthiness when selecting a test to administer. The chapter also provides an explanation of two statistics: correlation coefficient and coefficient of determination. We present these statistics as they are foundational to understanding much of what is presented in this and future chapters. In this chapter, we enhanced the section on negative correlation to improve readability, and we added figures to visually depict representations of different types of validity.

Chapter 6: Statistical Concepts: Making Meaning Out of Raw Scores

Chapter 6 starts by noting that raw scores generally provide little meaningful information about a set of scores. We then provide ways that we can manipulate raw scores to make sense out of a set of data, and we examine how the following concepts are used to help us understand raw scores: frequency distributions; histograms and frequency polygons; cumulative distributions; the normal curve; skewed curves; measures of central tendency such as the mean, median and mode; and measures of variability, such as the range, semi-interquartile range, and standard deviation. A couple of the updates to this chapter include an explanation why calculators sometimes give a slightly different standard deviation than the standard deviation you will get when you use the formula in the book and a second formula has been added for the calculation of standard deviation.

Chapter 7: Statistics Concepts: Creating New Scores to Interpret Data

In Chapter 7 we examine how raw scores are converted to what are called “derived” scores so that individuals can more easily understand what their raw scores mean. We first distinguish between norm-referenced and criterion-referenced testing and then go on to discuss the following derived scores: (1) percentiles; (2) standard scores, including z -scores, T -scores, deviation IQs, stanines, normal curve equivalents (NCE’s), sten scores, college entrance exam scores (e.g., SATs and ACTs), and publisher-type scores; and (3) developmental norms, such as age comparisons and grade equivalents. The chapter then examines standard error of measurement and standard error of estimate, both of which offer ways of understanding the range in which one’s “true score” actually falls. The chapter concludes with a discussion of nominal, ordinal, interval, and ratio scales in which we explore each scale’s unique attributes and note that different kinds of assessment instruments use different kinds of scales. In this chapter, we have updated critical information on a number of standard scores, such as the SATs, GREs, and ACTs.

SECTION III: COMMONLY USED ASSESSMENT TECHNIQUES

Section III, which includes Chapters 8 through 12, examines some commonly used assessment procedures. Throughout these chapters, we have carefully updated information on many of the tests discussed. At the beginning of this section, we offer an overview of some studies conducted with counselors and psychologists regarding the kinds of testing and assessment instruments they use and also offer a table that identifies the instruments we will cover in this section of the book. We note that most of the instruments we cover are used by a large portion of counselors and psychologists. Each of the chapters in this section has a specific focus that helps to delineate the kinds of assessment procedures used.

Chapter 8: Assessment of Educational Ability: Survey Battery, Diagnostic, Readiness, and Cognitive Ability Tests

Chapter 8 examines tests typically given in schools to measure what students have learned and what they are capable of learning. After defining the various categories of assessment of educational ability, we give examples of survey battery achievement tests, diagnostic tests, readiness tests, and cognitive ability tests. Throughout the chapter, we offer insight into the world of high-stakes testing and some of the important issues raised as the result of such laws as No Child Left Behind. In this chapter, we have added information about the Wechsler Individual Achievement Test (WIAT) and the Woodcock-Johnson[®] III, expanded the discussion of readiness testing, and provided the latest information about college and graduate school tests.

Chapter 9: Intellectual and Cognitive Functioning: Intelligence Testing and Neuropsychological Assessment

Chapter 9 explores intellectual and cognitive functioning. Here, we offer a brief history of intelligence testing and of neuropsychological assessment, define these two areas, and describe differences and similarities between them. The chapter also offers an overview of some of the more popular models of intelligences, and we present some common verbal and nonverbal tests of intelligence as well as types of neuropsychological assessments. In this edition, we have added two new theories of intelligence, the Cattell-Horn-Carroll (CHC) integrated model of intelligence and the triarchic theory of successful intelligence; added information about the Wechsler Nonverbal Scale of Ability (WNV), and provided an updated discussion of the use of neuropsychological assessment as applied to individuals with traumatic brain injury, such as returning service members from Iraq and Afghanistan.

Chapter 10: Career and Occupational Assessment: Interest Inventories, Multiple Aptitude, and Special Aptitude Tests

Chapter 10 examines the kinds of tests that can help individuals make decisions about their occupational or career path. We begin with an examination of interest

inventories, which are a type of personality assessment that generally look at individuals' likes and dislikes as well their personality orientation toward the world of work. We next explore multiple aptitude testing, which can help individuals identify the range of skills and abilities that may be important in choosing an occupation. We conclude with a look at some of the more popular special aptitude tests that look at focused areas of ability, such as clerical skills, mechanical skills, artistic skills, and musical ability. In this edition, we added information on O*NET and its Career Exploration Tools and discuss the new computerized version of the Armed Services Vocational Aptitude Battery (CAT-ASVAB).

Chapter 11: Clinical Assessment: Objective and Projective Personality Tests

Chapter 11 examines the process of using tests for clinical assessment. We start by underscoring the fact that such assessment has a wide variety of applications and can be an important tool for the clinician or researcher. The chapter then defines clinical assessment and speaks of some of the critical issues that such assessment can address. The meat of the chapter is a review of a number of the more well known and used objective and projective clinical assessment procedures. This edition has added information on the Conners 3 instrument for assessing ADHD and the Beck Anxiety Inventory (BAI).

Chapter 12: Informal Assessment: Observation, Rating Scales, Classification Methods, Environmental Assessment, Records and Personal Documents, and Performance-Based Assessment

This final chapter of the book covers informal assessment procedures. We start by defining informal assessment and then identify a number of different kinds of informal assessment techniques, including observation, rating scales, classification methods, environmental assessments, records and personal documents, and performance-based assessment. The second part of the chapter offers a discussion concerning test worthiness of informal assessment. In this edition, we provide an expanded genogram as a model to use to inquire about patterns in family and family assessment.

GLOSSARY AND APPENDICES

At the end of the book, we offer a glossary of all of the major words and terms used in the text. This should be helpful in remembering some of the basic concepts you read about. Also, within each chapter, you will find important concepts highlighted in the margins. *Essentials of Testing and Assessment* offers six appendices to enhance some of the issues identified in the text. Appendix A offers the Web sites of major professional associations and their accompanying ethical codes, Appendix B presents the assessment sections of ACA's and APA's ethical codes, Appendix C provides the Code of Fair Testing Practices in Education,

Appendix D offers an example of a test report that should be helpful as a guide when you write your own report. Appendix E offers supplemental statistical equations to help guide you in some of aspects of tests statistics, and Appendix F provides a conversion table of percentiles from z -scores

FINAL THOUGHTS

We believe this book is comprehensive without being overbearing. The text provides an overview of testing and assessment in a readable, and we think, enjoyable fashion. We hope that after reading it, you come away with a new appreciation of testing and assessment.

ACKNOWLEDGEMENTS

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Understanding the Assessment Process: History, Ethical and Professional Issues, Diagnosis, and the Assessment Report

SECTION

I



Section I of this book includes four chapters: Chapter 1: History of Testing and Assessment; Chapter 2: Ethical, Legal, and Professional Issues in Assessment; Chapter 3: Diagnosis in the Assessment Process; and Chapter 4: The Assessment Report Process: Interviewing the Client and Writing the Assessment Report.

In the first chapter, we define testing and assessment and examine the history of testing and assessment starting with ancient times and working our way to the development of modern-day assessment instruments. Near the end of the chapter, we examine current categories of assessment instruments, including ability testing (testing in the cognitive realm), personality assessment (testing in the affective realm), and informal assessment techniques. The chapter concludes by raising a number of concerns that continue to face us today as we administer assessment instruments.

Chapter 2 examines the many complex ethical, legal, and professional issues that confront individuals who are assessing others. We identify aspects of major ethical codes that focus on assessment; summarize standards that have been developed to help guide the practitioner when administering, scoring, and interpreting assessment procedures; and discuss the process of ethical decision making. We then examine legal issues that have impinged on the use of tests, professional associations that focus on assessment, and organizations that accredit programs that teach assessment. A discussion on the professional field of forensic evaluation then ensues and the chapter concludes with a discussion of assessment as a holistic process and issues of bias in testing.

In Chapter 3, we begin by discussing the importance of making a diagnosis. We then go on to introduce the *Diagnostic and Statistical Manual of Mental Disorders*, 5th edition (DSM-5), which is the common diagnostic tool used by almost all clinicians. We offer a brief history of the DSM, discuss the recent changes that took place in the development of DSM-5 from DSM-IV-TR, offer a brief overview of the various diagnostic classifications, and demonstrate how DSM-5 is used in assessing a client. We conclude the chapter with a discussion of the importance of diagnosis in the total assessment process.

Chapter 4 highlights the importance of the assessment report and suggests the report is the “deliverable” or “end product” of the assessment process. Here, we offer guidelines for conducting an effective interview, and we distinguish among structured, unstructured, and semi-structured interviews. In Chapter 4, we discuss the importance of choosing assessment measures that match the client’s presenting issues, and we stress the importance of considering the breadth and depth of clients’ issues when choosing assessment procedures. The rest of Chapter 4 is dedicated to ways of writing effective test reports, and we delineate topics that should be covered to create a thorough assessment of a client. An example of a fictitious client is offered as we show how each section of the assessment report should be written. The complete assessment report can be found in Appendix D of the book.

History of Testing and Assessment

CHAPTER

1



You walk into the room, prepared to take the test and know that the results will impact your future. You can feel your heart begin to pound and your stomach being to churn. “OMG, I hope I can do well, you say to yourself.”

With millions of children and adults frightened by the thought of taking a test, this is not a pretty picture. But is there value in this sometimes-terrifying experience? We’ll let you answer that question after you have finished reading this book. But how did test-taking start? That question will be answered in this chapter.

(Ed Neukrug)

In this chapter we will examine the history of testing and assessment. First, we will explore the differences between testing and assessment and point out how their current definitions are directly related to their history. We will then take a ride through the history of assessment, starting with ancient history and working our way to the development of modern-day assessment instruments. Along the way, we will highlight some of the people who were pioneers in the development of assessment measures and discuss some of the controversial issues that arose. As the chapter nears its conclusion, we will examine the current categories of assessment instruments, and we will finish by raising a number of ongoing concerns surrounding the use of assessment instruments.

DISTINGUISHING BETWEEN TESTING AND ASSESSMENT

Assessment

A broad array of evaluative procedures

Today, the term *assessment* includes a broad array of evaluative procedures that yield information about a person (Hunsley, 2002). Assessment procedures include the clinical interview; informal assessment techniques such as observation, rating scales, classification methods, environmental assessment, records and personal documents, and performance-based assessment; personality tests such as objective tests, projective tests, and interest inventories; and ability tests such as achievement tests and aptitude tests (see Figure 1.1).

Tests

Instruments that yield scores based on collected data—a subset of assessment

Tests are a subset of assessment techniques that yield scores based on the gathering of collective data (e.g., finding the sum of correct items on a multiple-choice exam). Assessment procedures can be formal, which means they have been well-researched and shown to be scientifically sound, valid, and reliable, or informal, which implies that such rigor has not been demonstrated, although the procedure might still yield some valuable information.

Generally, the greater the number of procedures used in assessing an individual, the greater the likelihood that they will yield a clearer snapshot of the client. Thus, using multiple assessment procedures, or a holistic approach to assessment,



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FIGURE 1.1 | Assessment Procedures

Multiple assessment procedures should always be considered

should always be considered when making important decisions about a client's life (Association for Assessment and Research in Counseling, 2012; Joint Committee on Testing Practices, 2004). In this text we will examine a broad array of formal and informal assessment procedures, all of which can be used in the decision-making process. But let's start at the beginning and see how events of the past have moved us toward our current use of assessment instruments.

THE HISTORY OF ASSESSMENT

Although the modern era of assessment began near the beginning of the twentieth century, assessment procedures can be found in ancient times. Let's examine some of the changes in assessment that have taken place over the centuries.

Ancient History

He said, "Take your son, your only son Isaac, whom you love, and go to the land of Moriah, and offer him there as a burnt offering on one of the mountains that I shall show you" (Genesis 22:5, New Revised Standard Version).

Assessment has been around for as long as humans have walked the earth. In fact, one might say that Abraham's loyalty was assessed when God asked him to kill his son Isaac. From a more down-to-earth perspective, the Chinese government is given credit for developing one of the first widely used tests when it began to assess individuals for fitness to work in government positions in approximately 2200 B.C.E. (DuBois, 1970; Higgins & Sun, 2002). With testing done under grueling conditions in hundreds of small cubicles or huts, it was not unusual that examinees would die from exhaustion (Cohen, Swerdlik, & Sturman, 2012). This kind of testing was not abolished until 1905. In the Western world, passages from Plato's (428–327 B.C.E.) writings indicate the Greeks assessed both the intellectual and physical ability of men when screening for state service (Doyle, 1974).

Precursors to Modern-Day Test Development

As experimental and controlled research spread throughout the scientific community during the 1800s, physicians and philosophers began to apply these research principles to the understanding of people, particularly in the area of cognitive functioning. For instance, working in mental asylums, the French physician **Jean Esquirol** (1772–1840) examined how language ability of individuals with intellectual disabilities was related to intelligence (Zusne, 1984; Drummond, 2009). Seen as having a condition called "idiocy," (Esquirol, 1838, p. 38), these individuals were viewed as having intellectual deficits as compared to a "normal" person reared in a similar environment. Esquirol's focus on language ability is often seen as the beginning of what later became known as the assessment of "verbal IQ." At around the same time, **Edouard Seguin** (1812–1880), also from France, suggested that the prognosis regarding intellectual deficits in children was worse if such deficits were associated with physiological problems. He suggested that physicians should "watch for a swinging walk, 'automatically busy' hands, saliva dripping from a 'meaningless mouth,' a 'lustrous and empty' look, and 'limited' or

Jean Esquirol
Used language to identify intelligence—
forerunner of
"verbal IQ"

Edouard Seguin
Developed the form board to increase motor control—
forerunner of
"performance IQ"

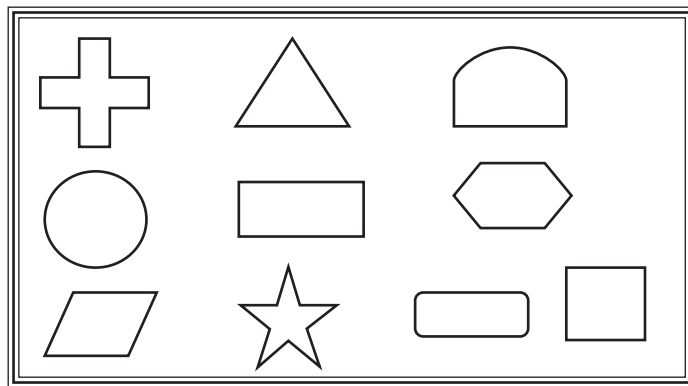
‘repetitive’ speech” (Zenderland, 1987, p. 54). Eventually, Seguin developed the form board to increase his patients’ motor control and sensory discrimination and to compare children and individuals with severe intellectual deficits to average children at different age groups (see Figure 1.2). Considered by some to be the forerunner of “performance IQ” measures (DuBois, 1970), versions of the form board, which is similar to the toy in which children place shapes in their respective grooves, are still used today in some performance-oriented IQ test.

Meanwhile, intrigued by Charles Darwin’s (1809–1882) theory of evolution, scientists during the mid-1800s became engrossed in trying to understand the development of the human species (Juve, 2008; Kerr, 2008). For instance, **Sir Francis Galton** (1822–1911), Darwin’s cousin, became fascinated by differences among people and eventually came to believe that people inherited physical and mental characteristics (Gillham, 2001; Murdoch, 2007). He hypothesized that some inherited physical traits, such as reaction time and stronger grip strength, might be related to superior intellectual ability. His curiosity led him to examine the relationship among such characteristics, and his research spurred others to develop the statistical concept of the *correlation coefficient*, which describes the strength of the relationship among variables (DuBois, 1970; Kerr, 2008). Calculating the correlation coefficient has become an important tool in the development and refinement of tests.

Sir Francis Galton
Examined relationship
of sensory motor
responses to
intelligence

Wilhelm Wundt
Developed one of the
first psychological
laboratories

Wilhelm Wundt (1832–1920), another scientist intrigued with human nature, set out to create “a new domain of science” that he called physiological psychology. Around 1875, at the University of Leipzig in Germany, Wundt developed one of the first psychological laboratories that used experimental research (Nicolas, Gyselinck, Murray, & Bandomir, 2002). Many of the experiments in Wundt’s laboratory studied reaction time of hearing, sight, and other senses in response to stimuli (Watson, 1968). A number of students who worked with Wundt helped to



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FIGURE 1.2 | Reproduction of Seguin’s Form Board

Task: Children, or individuals with intellectual disabilities, would be given ten blocks, in three piles, and asked to place them in the slots as fast as they can. They would then determine intellectual age by finding which age group the individual was most similar to.

James McKeen Cattell
Brought statistics to mental testing—
coined term mental test

G. S. Hall
Early experimental psychologist. First president of APA

foster in the new age of psychological science. For instance, **James McKeen Cattell** (1860–1944), a doctoral student under Wundt who was later greatly inspired by Galton, became one of the earliest American psychologists to use statistical concepts in understanding the person (Goodwin, 2008; Roback, 1961). Cattell’s main emphasis became the assessment of what he termed *mental tests* and included examining individual differences of such things as memory span and reaction time. Another important figure, **G. S. Hall** (1844–1924), also worked with Wundt and eventually set up his own experimental lab at Johns Hopkins University. Hall became a mentor to other great American psychologists and was the founder and first president of the American Psychological Association in 1892 (Benjamin, 2008).

The Emergence of Ability Tests (Testing in the Cognitive Domain)

Influenced by the new scientific approach to understanding human nature, researchers at the beginning of the twentieth century began to develop instruments that could scientifically measure an individual’s abilities. This era saw the emergence of ability tests, including individual intelligence tests, neuropsychological assessments, and group tests of ability.

Alfred Binet
Created first modern intelligence test

Intellectual and Cognitive Functioning: Intelligence Testing and Neuropsychological Assessment Although commonplace today, the first intelligence tests were developed by **Alfred Binet** (1857–1911) who, in 1904, was commissioned by the Ministry of Public Education in Paris, to construct a test that could be of assistance in integrating what they called “subnormal” children into the schools (Binet & Simon, 1916). Highly critical of the manner in which “mental deficiency” was diagnosed in children, Binet and his colleague Theophile Simon developed a scale that could be administered one-on-one and which would measure higher mental processes by assessing responses to a variety of different kinds of tasks (e.g., tracking a light, asking the individual to distinguish between different types of words) (Ryan, 2008). The information gained from their observations was then used to develop the first modern-day intelligence test (Watson, 1968). A relatively short time later, **Lewis Terman** (1877–1956), from Stanford University, began analyzing and methodically gathering extensive normative data on Binet and Simon’s scale from hundreds of children in the Stanford, CA area (Jolly, 2008; Kerr, 2008). Based on the data, Terman made a number of revisions to the Binet and Simon scale. Originally called the Stanford Revision of the Binet and Simon scale, the test later became known as the Stanford-Binet, the name by which the revised version continues to be known as today. Terman was the first to use the term *intelligence quotient*, or “IQ,” which used a ratio of mental age to chronological age (see Box 1.1).

Lewis Terman
Enhanced Binet’s work to create Stanford-Binet intelligence test

Intelligence quotient
Mental age divided by chronological age

Intelligence tests are sometimes used in neuropsychological assessment, which examines changes in brain function as the result of injury or disease process. Interest in how the brain impacts cognitive and behavioral functions, however, can be traced back to early Egypt where observations of behavioral changes following head injuries are recorded in 5,000-year-old Egyptian medical documents (Hebben & Milberg, 2009). In modern times, research conducted during World War I examined

BOX 1.1**Developing the Notion of “IQ”**

Lewis Terman wanted to develop a logical and relatively easy way of expressing an individual's intelligence. Using the data from his research, he quickly realized that he could compute a ratio score for each child by dividing a child's mental score (the age score at which the child performed) by the child's actual age. Thus, if a child was performing at the level of the average 12-year-old but was actually 9 years old, the ratio would be $12/9$ or 1.33. Multiplying this number by 100 to eliminate the decimal point would yield an intelligence quotient (“IQ”) of 133*.

*Note: IQ is no longer determined in this manner, and the current method of calculation will be discussed later in the text.

Use this method to determine the IQs of the children below, based on their mental age scores and their actual ages.

Child 1: mental age of 6 and chronological age of 8.

Child 2: mental age of 16 and chronological age of 16.

Child 3: mental age of 10 and chronological age of 9.

Answers: Child 1: 75 ($6/8 \times 100$), Child 2: 100 ($16/16 \times 100$), Child 3: 111 ($10/9 \times 100$).

behaviors of soldiers who suffered from brain injuries. At that time, with the testing movement in full swing, it is not surprising that new screening and diagnostic measures to assess behavioral changes due to brain trauma were created (Lezak, Howieson, Bigler, & Tranel, 2012). During the twentieth century, as individuals became more interested in the nature of the brain and spurred on by the use of X-rays and other forms of brain imaging, the field of neuropsychology, or the study of brain function as it relates to behavior, was established. Today, when suspected changes occur in brain function due to disease, accidents, or violence, a “neuropsych” assessment, which sometimes includes an intelligence test, is often used.

Group Tests of Ability (Group Testing in the Cognitive Domain) Realizing the importance of obtaining accurate information from examinees, early test developers, such as Terman and others, devised standardized directions to use in testing and stressed the importance of having trained examiners administer tests individually (Geisinger, 1994; Jolly, 2008). However, it was soon evident that individual testing, such as that conducted when doing intelligence testing, often took a particularly long time and was costly. During World War I, these practical concerns came to a head as it became critical to quickly administer tests of cognitive ability in order to place large groups of recruits in the military. At that time, **Robert Yerkes**, the president of the American Psychological Association, chaired a special committee to create a screening test for these new recruits. The committee, composed of many well-known psychologists, including Terman, prepared a draft of the test in just four months (Geisinger, 2000; Jones, 2007). The original test the committee developed was known as the **Army Alpha** (see Box 1.2 and Illustration 1.1).

Although the Army Alpha clearly had its problems, it was a large step toward the mass use of tests in decision-making and was administered to more than 1.7 million recruits in less than two years (Haney, 1981). Since there were many foreign-born recruits and large numbers of people who could not read, a second

Robert Yerkes
Chairman of the committee that developed the Army Alpha

Army Alpha
First modern group test—used during WWI

BOX 1.2 The Army Alpha Test

The Army Alpha test was created to place recruits in the military (Jones, 2007; McKean, 1985). Based on this test, it was found that average mental age of the

recruit was 13. Take the test below in the 3-minute time allotment given, then consider potential issues of bias and cultural fairness of the questions on the test.

The Army Alpha was used to determine placement in the armed forces during WWI. Below is an adaptation of the test, as printed in *Discover* magazine. Take the test and discuss your thoughts about it.

The average mental age of the recruits who took the Army Alpha test during WWI was approximately 13. Could you do better? You have three minutes to complete these sample questions, drawn verbatim from the original exam. (McKean, 1985)

The following sentences have been disarranged but can be unscrambled to make sense. Rearrange them and then answer whether each is true or false.

1. Bible earth the says inherit the the shall meek. true false
2. a battle in racket very tennis useful is true false

Answer the following questions:

3. If a train goes 200 yards in a sixth of a minute, how many feet does it go in a fifth of a second?
4. A U-boat makes 8 miles an hour under water and 15 miles on the surface. How long will it take to cross a 100-mile channel if it has to go two-fifths of the way under water?
5. The spark plug in a gas engine is found in the: crank case manifold cylinder carburetor
6. The Brooklyn Nationals are called the: Giants Orioles Superbas Indians
7. The product advertised as 99.44 per cent pure is:
Arm & Hammer Baking Soda Crisco Ivory Soap Toledo
8. The Pierce-Arrow is made in: Flint Buffalo Detroit Toledo
9. The number of Zulu legs is: two four six eight

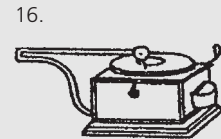
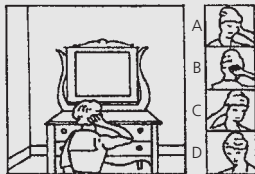
Are the following words the same or opposite in meaning?

10. vesper–matin same opposite
11. aphorism–maxim same opposite

Find the next number in the series:

12. 74, 71, 65, 56, 44, Answer:
13. 3, 6, 8, 16, 18, Answer:

14. Select the image that belongs in the mirror: 15. & 16. What's missing in these pictures?



Answers: 1. true, 2. false, 3. twelve feet, 4. nine hours, 5. cylinder, 6. superbas, 7. Ivory Soap, 8. Buffalo, 9. two, 10. opposite, 11. same, 12. 29, 13. 36, 14. A, 15. spoon, 16. gramophone horn

Scoring: All items except 3, 4, 10, and 11 = 1.25 points. Items 3 and 4 = 1.875 points, Items 10 & 11 = .625 points. Add them all up, they equal your mental age. What is wrong with this test? Examine it for problems with content, history, cross-cultural contamination, and so forth.

Source: McKean, K. (1985). Intelligence: New ways to measure the wisdom of man. *Discover Magazine*, 6(10), 28. Reprinted by permission of Disney Publications.