History of Psychology

FOURTH EDITION

David Hothersall
The Ohio State University

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About the Author

DAVID HOTHERSALL is an emeritus professor of psychology at The Ohio State University. Born and raised in England, he came to the United States in 1965 and received his Ph.D. from the University of Tennessee in 1968. Since then he has been at Ohio State. The recipient of a number of teaching awards, including Ohio State's Alumni Award for Distinguished Teaching, he has taught courses on the history of psychology to both undergraduate and graduate students. In addition to the history of psychology, his teaching interests include introduction to psychology for honors students. He has written numerous papers on learning and memory as well as an introductory psychology text published in 1984. From 1990 to 1998, he was the director of The Ohio State University Honors Program. He now teaches courses on the history of psychology to undergraduate and graduate students at Ohio State and to advanced undergraduate students at Ohio Wesleyan University.

To Calvin Mark David and
Mitchell Walter Ernest Meyer

Brief Contents

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Preface

Revisions and extensions in this fourth edition are more extensive than in the three earlier editions. They are based on the feedback I have received from faculty members who have used the book in their history of psychology courses and, in a smaller number of cases, from students taking the class. A common theme has been that the history of psychology as outlined in this book is far from being tedious and dull. Rather it is lively and interesting, since so many historically important psychologists were fascinating, sometimes controversial and often engaging. Such reactions reaffirm the biographical approach I have taken to the history of psychology.

I have also relied upon my own experience teaching history of psychology courses at both the undergraduate and graduate level at The Ohio State University and to advanced undergraduate students at Ohio Wesleyan University. Students in those classes have given me invaluable feedback on the text and have suggested material to be added or deleted. Finally, I have made extensive use of the growing literature on the history of psychology. Of the 250 new references and citations in this new edition, 148 are to papers and books published from 1995 to 2002. There are numerous references to works published last year. The text reflects and includes much contemporary scholarship in the history of psychology. Publications such as *Journal of the History of the Behavioral Sciences* and *History of Psychology* include articles of impressive scholarship and research on the history of psychology. I am deeply indebted to their editors and to the many contributors whose works I have read and cited. In addition, the *American Psychologist* and C*ontemporary Psychology* continue to publish papers and reviews on the history of psychology. Those papers reflect an interest in the history of psychology held by a broad range of psychologists. The Archives of the History of American Psychology at the University of Akron-Bierce Library and the *Newsletter for the Friends of the Archives of the History of American Psychology* are dedicated to preserving psychology's history.

A new resource that has come to prominence since the last edition is the Internet. Many excellent web resources on the history of psychology are now available, including hundreds of original papers. To have such works available at the click of a mouse is a wonderful gift. Complete listings of web resources in the history of psychology for both instructors and students are in the custom *Course Website* and *Instructor's Manual.*

An increased number of boxes highlighting contributions, controversies, and links between past and contemporary psychology appear in this edition. Unusual terms, phrases, and words are defined throughout the book. Special attention has been paid to neglected contributors to psychology, especially to women. The book's biographical approach is well-suited for exploring why so many women have been overlooked. The history of such episodes is both sad and instructive.

Supplementing this edition are a new custom *Course Website* and *Instructor's Manual* prepared by Professor Robert Tigner. Professor Tigner is uniquely qualified to prepare these materials having used this text in his courses on the history of psychology, reviewed earlier editions of this *History of Psychology,* and taken my course on the history of psychology as a graduate student at Ohio State. This online resource provides numerous study aids to enhance the learning experience. Students will find chapter outlines, objectives, discussion questions, and practice quizzes to complement the text. Additionally, an interactive series of flashcards featuring key people and terms is provided for each chapter. Students interested in pursuing topics in greater detail will find numerous links to additional Internet resources. The *Instructor's Manual* (available on CD-ROM) has been completely redesigned and rewritten for the fourth edition. In addition to an extensive test bank of multiple-choice questions, the *Instructor's Manual* contains chapter outlines, web links to related sites, thoughtful essay questions, and interesting class assignments and activities for each chapter.

As with earlier editions, this *History of Psychology* is intended for both advanced undergraduate students majoring in psychology and graduate students. Its length makes it suitable for either a quarter- or semester-long course on the history of psychology. My hope is that the book will develop undergraduate students' interest in psychology and reinforce graduate students' commitment to psychology as a profession.

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In addition, Robert Tigner, Harold Kiess, Kathy Milar, Benjamin Miller, Dorothy Pace, and Claudia Thompson wrote prepublication reviews that were most helpful and constructive. Many others provided suggestions and comments. I am especially grateful to Ludi Benjamin, Jr., Raymond Fancher, George Windholz, Allen Esterson, Kevin Lanning, Donald Polzella, and Todd Wiebers.

This edition was prepared and written during a period of personal and professional transition. I am most grateful for the friendship and support of my colleagues at Ohio State and Ohio Wesleyan. My family has been a constant source of support. My love for them is immeasurable.

David Hothersall

Introduction

RECURRENT QUESTIONS FOR PSYCHOLOGY

In 1910, just thirty years after Wilhelm Wundt founded the first psychological research laboratory in 1879, Hermann Ebbinghaus described psychology as having "a long past but only a short history" (Ebbinghaus, 1910, p. 9). Compared with the established sciences of astronomy, anatomy, physics, chemistry, and physiology, psychology had indeed had a "short history." But, as Ebbinghaus noted, psychology's "short history" was complemented by a "long past"; many of the questions and concerns of psychology can be traced back to the ancient worlds of Egypt, Greece, and Rome (Chapter 1).

Perhaps the most pressing question throughout psychology's "long past" has been whether a science of the mind, a psychology, is possible. If it is, how is it to be defined and what should its methods be? In the nineteenth century, Auguste Comte denied the possibility of a science of the mind. The mind, Comte asserted, can study all phenomena but its own. His contemporary, John Stuart Mill, refuted Comte's assertion and proposed a science of the mind, a model of the mind's operations, and a method for studying its contents (Chapter 2). Wilhelm Wundt adopted and extended Mill's position (Chapter 4) when he established a science of psychology and developed methods that allowed the classic question of the epistemologists[1]—"How do we see, perceive, and have knowledge of the world?"—to be addressed scientifically. One of the triumphs of the first generation of psychologists was Ebbinghaus's research on human memory (Chapter 6). He was able to show that memory can be studied scientifically and that the methods of psychology can be as rigorous and its results as reliable as those of older, established sciences. Ebbinghaus's results remain unchallenged today.

In the twentieth century, J. B. Watson (Chapter 12) urged that psychology abandon all concern with the mind and study only behavior. His radical proposal and methods gave birth to *behaviorism;* through the influence of his

[1] *epistemology*, n. A branch of philosophy that investigates the origin, nature, methods, and limits of human knowledge (*Random House Dictionary of the English Language*, p. 480).

successor, B. F. Skinner, behaviorism became the dominant approach to psychology in America. Today, study of the "mind" in the form of *cognitive psychology* is experiencing a renaissance within psychology, and much of the research of cognitive psychologists bears a striking similarity to research and theories developed by Franz Brentano and Oswald Külpe (Chapter 6) and Edward Tolman (Chapter 13). Psychologists have struggled to define both the subject matter and the methods of psychology throughout its history. Their struggles are described in this book.

A second recurrent question in the history of psychology and philosophy concerns the nature and locus of the mind. As we will see, the ancient philosophers had curious ideas about the seat of the mind. Aristotle located it in the heart. Today we confidently locate the mind in the brain and describe mental functions as products of the brain's operations. The brain is seen as central. Since the nineteenth century (Chapter 3), researchers have made great progress in understanding the brain, and today's neurosciences, one of which is physiological psychology or psychobiology, represent a large collection of investigators from many disciplines. Perhaps because of its complexity—with its 120 billion nerve cells and estimated 1 quadrillion potential connections between them—the brain is often described as the most complex structure ever studied. A complete description of the relationship between the brain and behavior as well as between the brain and consciousness eludes us.

A related problem for philosophy and psychology has been to find a way to describe the relationship between mind (brain) and body—to find a model of their relationship. Are they separate and distinct, parallel, interacting, or inseparably linked? Each of these positions has had advocates, and their views continue to influence models of mind-body interactions. Today's holistic models, for example, in which mind and body are viewed as one, are sometimes presented as being new and revolutionary. In fact, such models are ancient and can be traced back through *A Guide for the Perplexed,* a medical book written in the twelfth century by Maimonides, to the ideas of the Greek physician Hippocrates in the fifth century B.C. (Chapter 1).

The relative contributions of *nature* (the genetic constitution) and *nurture* (the environment) to development and to individual differences have been debated endlessly. Aristotle favored an environmentalist position, stressing the importance of *nurture.* Indeed, it was Aristotle who first used the lasting metaphor of the mind at birth as a *tabula rasa,* or blank tablet, to be filled by experience. Plato recognized the importance of individual differences in temperament, character, and ability, but he believed that such dispositions are largely inborn and therefore adopted the position of a *nativist* (Chapter 1). Throughout the history of psychology, these *empiricist* and *nativist* positions recur: *empiricism* in the philosophies of John Locke, James and John Stuart Mill, and the later psychologies of J. B. Watson and B. F. Skinner; *nativism* in the philosophies of René Descartes and Immanuel Kant and the psychologies of Francis Galton, G. Stanley Hall, and Lewis Terman. *Nature versus nurture* is still one of the most actively debated and divisive concerns of contemporary psychologists (Pinker, 2002). Indeed, the divisions run so deep that some have argued that rational discourse between proponents of environmental influences and proponents of genetic influences on the development of intelligence has become out of the question (Crawford, 1979). Such a pessimistic conclusion is unwarranted; contemporary research using paradigms originally proposed by Francis Galton (Chapter 9) has provided intriguing and powerful evidence as to the contributions of nature and nurture.

LESSONS FROM PSYCHOLOGY'S PAST

Psychology textbooks typically describe psychologists' successes. This history of psychology, by contrast, describes both their successes and their failures. At times eminent psychologists have advocated with great confidence and conviction answers to the questions of psychology that later proved to be wrong. To describe past errors is not to discredit, debunk, or diminish past psychologists, for often they answered other questions correctly; rather, it is to make the history of psychology complete and, most importantly, to alert us to our own fallibility. We must also avoid the tendency to interpret and evaluate the contributions of earlier psychologists according to the standards of the present. Raymond Fancher (1987) labeled such tendencies "Whig history." This book will not be a Whig history of psychology.

In many instances, our errors may not be readily apparent to us because the shared beliefs and assumptions of a particular era support them. The leading historian of psychology, Edwin G. Boring (1957), described such influences as coming from the *Zeitgeist,* or spirit of the times. An illustration of the effects of the *Zeitgeist* is seen in the research of Pierre-Paul Broca. His studies of the localization of speech in the human brain (Chapter 3) are still considered distinguished. But Broca was also convinced that women are inferior products of evolution, that their brains are significantly less developed than those of men, and that this difference in brain size increases with each generation. We now know that his conclusions were in error and were based on inadequate and poorly conducted research. However, since they were in harmony with prevailing assumptions and beliefs of the time, they went unchallenged.

A similar example can be found at the beginning of the twentieth century. At that time, the consensus among leading psychologists such as Henry Goddard and Lewis Terman (Chapter 11) was that existing psychological tests adequately measured basic intelligence in diverse groups of people, even those from different racial, ethnic, and cultural backgrounds. Today we are aware of the inherent cultural bias in many psychological measures, and we strive to develop "culture-fair" tests. Unfortunately, in Terman and Goddard's times, the cross-cultural validity of existing tests was not questioned, and the results from different ethnic, cultural, national, and racial groups were accepted, largely because such results agreed with prevailing assumptions and beliefs about those groups. The consequences of this misapplication of psychological tests were both unfair and tragic (Chapter 11), yet both Goddard and Terman made other important contributions to psychology. In the 1920s, Goddard established one of the first school enrichment programs for gifted children, while Terman planned, initiated, supported, and for many years conducted one of the most respected psychological studies ever done, his long-term study of children of genius.

Failure to question research findings that agree with prevailing political and philosophical ideology represents one of the effects of the *Zeitgeist*. Having seen how the *Zeitgeist* operated in the past, we may be more aware of its influence on contemporary psychology. The influences of prevailing political, philosophical, and scientific ideology are not always negative. In many instances, the spirit of the times—as reflected by the interaction of all the sciences and technology—can stimulate new ideas and creative solutions to problems. One such positive influence appears in the models and metaphors chosen to describe behavior and consciousness. Descartes (Chapter 2) described the body as a machine like the machines he saw in the gardens of seventeenth-century France. William Harvey, living during England's industrial revolution, saw the heart as a pump whose task is to drive blood through the body. Wilhelm Wundt and Edward Titchener (Chapters 4 and 5) set out to emulate Newtonian physics and modeled their psychology on that science, hoping not only to adopt the rigor and elegance of its methods but also its goals. Early in the twentieth century, the *behaviorists* and *neobehaviorists* (Chapters 12 and 13) adopted a switchboard model of behavior; they saw the task of psychology as accounting for connections between stimuli and behavioral responses. Today computer models of behavior and consciousness are in vogue, and psychologists refer to cognitive processes in terms of information processing, storage, input and output, and storage capacity—all terms and concepts drawn from computer science. Twenty years from now, this computer model may appear as outmoded as switchboard models of stimulus and response do today. But throughout history, we see that the value of such models does not reside in their accuracy as descriptions of psychological phenomena, but in their capacity to direct psychological research and theorizing.

Another aspect of psychology's past that this history will stress is that earlier psychologists conducted research and speculated about psychological phenomena in ways that have turned out to be remarkably prescient. At times, generations of psychologists have forgotten such research and speculation, only to rediscover it later. In the seventeenth century, John Locke described a clinical procedure for overcoming excessive fears (Chapter 2) that bears a remarkable resemblance to the systematic desensitization procedures developed by Joseph Wolpe and other contemporary behavior therapists for the treatment of phobias. Hugo Münsterberg (Chapter 5) wrote extensively in the first decade of the twentieth century on the reliability of human memory and particularly of eyewitness testimony. During the 1970s, research similar to that of Münsterberg was again conducted (Loftus, 1980). In the 1920s, Sidney Pressey invented teaching machines and conducted research on their effectiveness compared with more traditional teaching methods. But his machines were a commercial failure, and his work has been largely forgotten. In the 1950s, B. F. Skinner developed his own teaching machine, and that application achieved considerable fame. The contrast between the obscurity of Pressey's pioneering teaching machines and the fame Skinner achieved is best understood in a historical context (Benjamin, 1988).

Gustav Fechner, the father of *psychophysics* (Chapter 2) knew in the nineteenth century that the human brain has two cerebral hemispheres linked by a band of fibers, the *corpus callosum*. He speculated that if it were transected or cut, two separate streams of consciousness would result; the mind would be, in effect, split in two. In recent decades, the *corpus callosum* has been transected in human patients to prevent the spread of epileptic seizures from one side of the brain to the other (Sperry, 1961). Reports describing these "split-brain" subjects have dramatically changed our understanding of the brain and in many ways confirmed Sperry's speculations. In 1981, nearly 100 years after Fechner's publication, Roger Sperry shared the Nobel Prize for medicine for his pioneering research on the consequences of sectioning the *corpus callosum.*

Such contributions and applications of later psychological findings are indeed impressive, but we must be careful not to read more into the work of earlier psychologists than was actually there. We must understand historical contributions as they actually were, rather than stressing how well they anticipate later findings.

HISTORY AS A UNIFYING OR CENTRIPETAL FORCE WITHIN PSYCHOLOGY

The first organizational meeting of the American Psychological Association (APA) was held in 1892 and was attended by twelve charter members (Chapter 9). The APA's first annual meeting was held in December of that year with eighteen members in attendance. In 1893, the Association had forty-three members and a budget of $63. For many years the convention was held on university campuses during the Christmas vacation. Times have changed. The APA's annual convention is now held in a major city's convention center and large downtown hotels, with 12,000 to 15,000 psychologists attending. The Association now has 84,400 members, fifty-five divisions, an annual budget of $40 million, and net assets of $33 million (Koocher, 2002). The American Psychological Association of Graduate Students (APAGS) has 59,700 student affiliate members, 15 percent of whom are undergraduates. The results of an international survey show the total number of psychologists in the world to be well over 500,000.[2] That number almost doubled from 1980 to 1990 (Rosenzweig, 1992). Canada, Mexico, Europe, Africa, India, Russia, and Japan have significant numbers of psychologists.

Psychology is now well-established as a science and profession, and psychologists are prominent in many areas of contemporary life. In 1992 a psychologist from Ohio, Ted Strickland, was elected to the United States Congress (De Angelis, 1993, p. 24). In his presidential address to the APA, Raymond Fowler (1990) described psychology as a "core discipline" that provides a basic core of knowledge used by other disciplines. With their understanding of human behavior, psychologists are viewed as well placed to contribute to the solution of major societal problems. Altman (1987) described such powerful centrifugal forces within psychology as close interactions with other fields, new research methods, and expanded training settings. He characterized such trends as beneficial to psychology, but others are less optimistic. A former APA president, Janet Spence, asked "Will the center (of psychology) hold?" Spence answered that it may not and described a "doomsday scenario" in which institutional psychology is decimated (Spence, 1987, p. 1053). Sarason in 1988 wrote

[2] The number of psychologists is about one-twelfth the number of physicians in the world (Rosenzweig, 1992, p. 718).

that "there is no longer a center in American psychology" (Sarason, 1988, p. 522). Philip Zimbardo in his *Discovering Psychology* series of twenty-six television programs asked all the prominent psychologists he interviewed, "What do you think will be the future of psychology?" Half replied that it would become more fragmented, with greater specialization; half expected psychology to become more holistic and unified (Zimbardo, 1989). Other psychologists are more hopeful as to the future of their field. Bower (1993) sees the fact that psychologists do so many different things in a variety of settings as a source of strength rather than weakness. This diversity makes psychology an exciting and dynamic discipline with a vast and growing literature. In 2000, the APA's twenty-nine journals published 1,653 empirical and scholarly articles (DeLeon, 2001, p. 551). That same year, 68,113 records were released in PsycINFO covering the world's literature in psychology (De Leon, 2001, p. 552).

On many college and university campuses, psychology is a popular, if not the most popular, undergraduate major. As a result, in the past forty years many psychology departments grew in the number of both their psychology course offerings and the psychologists on their faculties. Courses on the history of psychology are numerous. Eighty-four percent of undergraduate institutions and 91 percent of departments with Ph.D. or Psy.D. graduate programs had a course on the history of psychology (Fuchs & Viney, 2002, p. 7). Scott (1991) has asserted that the future may not be so positive for psychology departments. According to his scenario, by the year 2050 psychology departments as they are now structured will be but a memory: Biopsychology will be taught in medical schools, cognitive psychology will be part of cognitive science coalitions, social psychology will be more practice oriented and will be found in professional schools, and clinical psychology will be a specialty in medical schools (Scott, 1991, p. 976).

One centripetal force unifying contemporary psychology is the common history all psychologists share. That history distinguishes and identifies psychology. There is a surprising degree of unanimity as to whom the great psychology figures of the past are. Psychology is unusual in that even the most contentious of psychologists would agree that Wundt founded their science. In other disciplines this question is not settled. Who founded economics, or chemistry, or physics? Korn, Davis, and Davis (1991) asked twenty-nine leading historians of psychology and ninety-three graduate department of psychology chairpersons to rank the ten most important psychologists of all time. Their rankings were:

Rank	Historians	Chairpersons
1	Wundt	Skinner
2	James	Freud
3	Freud	James
4	Watson	Piaget
5	Pavlov	Hall
6	Ebbinghaus	Wundt
7	Piaget	Rogers
8	Skinner	Watson
9	Binet	Pavlov
10	Fechner	Thorndike

(Korn et al., 1991, p. 790)

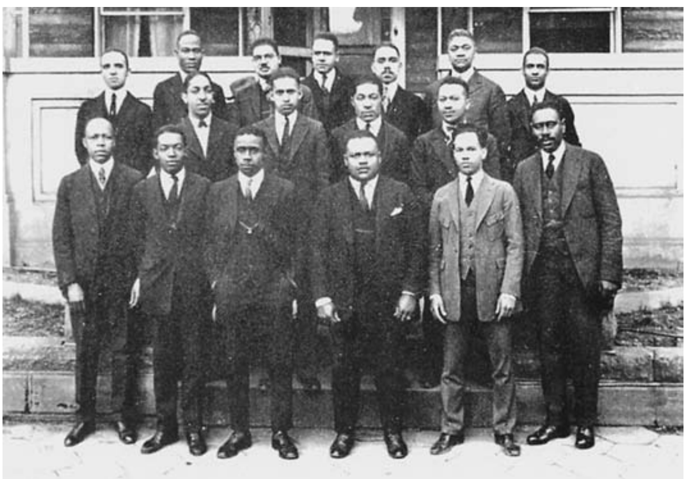
Ebbinghaus, Binet, and Fechner are on the historians' list but were not ranked by the chairpersons. Hall and Thorndike were ranked by the chairpersons but not by the historians. Except for Piaget and Rogers, all these psychologists will be discussed in detail in this book. They, along with Anna Freud, Kurt Lewin, Dorothea Dix, Hugo Münsterberg, Edward Tolman, and many others, belong to all psychologists. Their contributions and those of many other men and women discussed in this book established and defined psychology. From them we can learn what psychologists have in common, what unity exists within the diversity of contemporary psychology.

All the psychologists listed by the historians and department chairs were white males. That is not surprising, for until recently the contributions of African-Americans and women have been neglected. We will now consider some of those contributors to the history of psychology and the reasons why they have been so overlooked.

Neglected African-American Psychologists

Until recently contributions by African-American psychologists have been neglected. Robert Guthrie (1976) outlined such contributions. He also described the discrimination and difficulties so many of them faced. The title of Guthrie's book *Even the Rat Was White* is both whimsical and sadly ironic.

The career of Francis C. Sumner illustrates the difficulties African-American psychologists faced (Bayton, 1975). Born in Pine Bluff, Arkansas in 1895, Sumner attended numerous elementary schools as his parents moved from town to town in search of work. He never attended high school. To gain admission to Lincoln University in Pennsylvania, Sumner was required to pass a written



Francis Sumner (1895–1954), last on the right, second row. A pioneer African-American psychologist who headed the department of psychology at Howard University for three decades.
(El Ojo, 1923)

examination. He did so and graduated in 1915 as the class valedictorian with a degree in philosophy. Sumner then took a second degree in English, with an elective in psychology at Clark University. He applied to graduate programs in psychology at American University and the University of Illinois but was denied admission. Sumner then sought the assistance of G. Stanley Hall, the president of Clark and a professor of psychology (Chapter 9). Hall had created some controversy at Clark by advocating the admission of women and minority graduate students (Goodchild, 1996). Sumner was accepted in 1917 with an avowed intention to study "race psychology." Almost immediately, he became embroiled in controversy. In 1918 Sumner wrote two letters to the editor of the *Worcester Gazette.* He denounced oppression of African-Americans in the United States and labeled World War I "a poor cause to serve" (Sumner, 1918, in Sawyer, 2000, p. 130). Reaction from the public, university trustees, faculty, and students was furious. Hall urged Sumner to write a letter of explanation and apology, and he did so. Sumner was drafted and, despite Hall's recommendation that he be trained as an officer, was sent to France as a sergeant in the infantry. Sumner survived the war and returned to Clark.

On the afternoon of June 11, 1920 Sumner successfully defended his dissertation *Psychoanalysis of Freud and Adler* in front of an examination committee that included Hall and Edwin G. Boring (Chapter 5). Sumner was awarded his Ph.D. that summer, the first African-American to earn a doctoral degree in psychology (Sawyer, 2000, p. 122). Statistics show the magnitude of his achievement. Of 10,000 Ph.D. degrees awarded by American universities between 1876 and 1920, only 11 were awarded to African-Americans (Spencer, 1994, p. 15).

Sumner then taught psychology at Wilberforce College in Ohio and Southern University in Louisiana. From 1921 to 1928 at West Virginia Collegiate Institute, now West Virginia State College, Sumner taught every psychology and philosophy course offered (Spencer, 1994, p. 15). All three of these institutions enrolled predominantly African-Americans. Sumner was keenly aware of the discrimination and prejudice they faced at many other colleges and universities. In two controversial articles published in *Educational Review,* Sumner called for a system of segregated and unequal higher education for African-Americans and whites. His justification for such a system was that "African-Americans were on a lower cultural level than the white race" (Sumner, 1926, p. 43). Sumner himself was a clear refutation of such a claim, as were many of his students.

In 1928 he accepted a position as professor of psychology and department chair at Howard University, positions he held until his death in 1954. Under Sumner's leadership:

> Howard became the leading producer of black M.A.s and Ph.D.s in psychology. In the mid 1970s, for example, of the then 300 black Ph.D.s in psychology, 20 percent had received their bachelor's or master's at Howard. There were an additional 200 terminal master's degrees held by black graduates of the university. (Spencer, 1994, p. 19)

Given this record, Guthrie correctly called Sumner "the father of black American psychologists." One of the most prominent of those black American psychologists was Kenneth B. Clark. His groundbreaking research on the effects of segregation on the education of black children was cited in the 1954 United States Supreme Court decision on *Brown v. Board of Education*, which declared segregation in American schools unconstitutional. Clark recalled that his life changed at Howard:

> One day in my sophomore year, I was sitting daydreaming in Psychology 1, looking out the window at two birds making love. When they flew away, I started listening to my professor, and I heard some very illuminating things about human behavior. From then on, I listened very hard to what he said and I decided, 'To hell with medical school. This is the discipline for me.' (Clark in Hentoff, 1982, p. 45)

Clark's professor was Sumner. After graduating, Clark entered Columbia University. A number of faculty members expected that he would need "compensatory courses." Yet on the matriculation examination for incoming graduate students, Clark ranked first. The puzzled faculty members concluded that "Sumner must be a pretty good teacher" (Hentoff, 1982, p. 46). Clark and his wife Mamie graduated in 1940, the first two black Ph.D.s in psychology awarded at Columbia. In 1971 Kenneth Clark was elected as the first African-American president of the American Psychological Association. He has been described as a model psychologist-activist (Phillips, 2000).

Since many psychologists choose not to indicate their ethnicity on membership surveys, it is impossible to give present numbers of minority-group psychologists. But there is no doubt that they are underrepresented. To its credit, the American Psychological Association has launched intensive recruitment and support programs for minority students. In addition, the number of courses on cross-cultural psychology in both psychology and black studies departments (Hicks & Ridley, 1979) evokes cautious optimism that underrepresented groups will come to be included in psychology.

Neglected Contributions by Women to Psychology's History

Women have also been neglected in the history of psychology. While the contributions of Anna Freud, Bluma Zeigarnik, Margaret Washburn, and Mary Cover Jones, among others, are outlined in this book and in many others, the contributions of many women have often been neglected. Florence Goodenough developed the *Draw-A-Person Test*, an important projective assessment technique; Anne Anastasi was a pioneer in developing psychological tests; Maud Merrill collaborated with Lewis Terman (Chapter 11) on the important 1937 revision of the Stanford-Binet intelligence test; Loretta Bender in 1938 applied the principles of Gestalt Psychology (Chapter 7) in developing the Bender-Gestalt Test; and Mary Henle is an influential historian of psychology whose first-person accounts of Gestalt psychology have been especially significant (Henle, 1978a, 1978b).

In recent years, an active area of historical scholarship has developed on the neglected contributions of women to psychology (Denmark, 1980; Furumoto & Scarborough, 1986). These scholars have identified and described important contributions made by numerous women psychologists. They have also outlined the formal, overt and covert discrimination and difficulties these women faced (Milar, 2000). Agnes O'Connell and Nancy Felipe Russo (1980, 1983, 1990) featured eminent women in psychology and described their contributions. It is apparent in these biographies that many of these women had to overcome blatant sexism by extraordinary talent and hard work.

Failure to recognize the contributions of women is especially ironic since for many decades significant numbers of women earned Ph.D. degrees in psychology. In the 1920s, 25 percent of all Ph.D. degrees in psychology awarded by American universities were earned by women. By 1980, that proportion had risen to 29 percent (Denmark, 1980, p. 1059). In 1985, 34 percent of all psychology Ph.D. degrees were awarded to women, and in 1993, 42 percent. In 1991, 61 percent of the students in full-time doctoral programs in psychology were women (Denmark, 1998, p. 467). Projections from current trends indicate that by 2010, 60 percent of psychology Ph.D.s will be awarded to women (Fowler, 1993, p. 2). Such changes have raised fears as to the consequences of the increasing "feminization" of psychology. The prominent and successful roles many women have played in psychology's recent history should allay such fears. Janet Spence served as APA's president, and Sandra Scarr was one of the founding members of the American Psychological Society. Since its founding in 1988, seven of the presidents of the American Psychological Society have been women. Four of the five candidates for APA's presidency in 2004 are women. From 1997 to 2000, two of the nine *Distinguished Scientific Contributions to Psychology* and three of the sixteen *Distinguished Scientific Awards for an Early Career Contribution to Psychology* awarded by the APA went to women. In 2002, both recipients of the *William James Award* honoring APS members for their significant intellectual contributions to the science of psychology were women; one of the two recipients of the *James McKeen Cattell Fellow Award* was a woman. In a broader context, two woman psychologists serve as presidents of major American universities: Judith Albino of the University of Colorado, and Judith Rodin of Yale. Rodin, chosen as president of Yale in 1993, was the first woman president of an Ivy League university (Martin, 1994, p. 7).

Feminist critics of psychology have gone so far as to describe psychology's history as a social construct by and for male psychologists (O'Connell & Russo, 1991). They also describe what they consider to have been a pervasive neglect of women and a pervasive male bias in psychology. The result, they claim, has been the creation of, "bodies of knowledge that are scientifically flawed—that are inaccurate for, and irrelevant to, half the human race" (Rabinovitz & Sechzer, 1993, p. 24). This neglect of women has been corrected. Hoffman and Quinton (1996) compared references to men and women in the entire literature of psychology from 1974 to 1994 using the *PsycLIT* and *SOCIOFILE* databases. Almost twice as many references (240,788 or 66 percent) were to women as to men (122,7611 or 34 percent). Hoffman and Quinton attributed this focus on women to the emergence of increasing interest in the psychology of women, the increasing numbers of women in psychology, and the emergence of new journals receptive to research and scholarship on women, such as *Psychology of Women Quarterly.*

This Book's Approach to the History of Psychology

In a famous book review in *The Edinburgh Review,* Thomas Babington Macaulay in 1828 defined history as a relentless contest between historians as analysts and historians as storytellers. The contest Macaulay described is seen in the scholarship on the history of psychology. Most books on the history of psychology focus on the major theoretical systems of philosophy and psychology and the ways in which they are linked conceptually from one generation of psychologists to the next. Such an approach allows the reader to understand how systems of thought evolve within a broad historical context. However, a danger lurks in such an analytical approach, especially if it is used exclusively, of neglecting individual psychologists. Hegel in his book *Reason in History,* originally published in 1837, described history's heroes as "world historical individuals" who "embody the very truth of their age and their world." This book will describe the Hegelian heroes and heroines of psychology's history. Hegel also described a "struggle for recognition" and the intense desire of human beings to have their inherent worth acknowledged. We will see such drives in the lives and careers of many of the psychologists in this book. We will also see how the circumstances of their lives, their personal experiences, and, at times, unlikely situations prompted new ideas and stimulated new directions of research and study.[3]

During World War I, Wolfgang Köhler was marooned on Tenerife, a lonely island in the Atlantic (Chapter 7). Tenerife had a colony of chimpanzees for research studies, so Köhler studied problem solving and insight learning by those animals. His research did much to establish the Gestalt approach to psychology. Before World War I, Franz Brentano, Carl Stumpf, and Oswald Külpe (Chapter 6) established an active tradition of cognitive research in Germany. Because of the war, this research was abandoned and their approaches and findings were neglected. Only in recent years have psychologists returned to the cognitive topics these psychologists pioneered. Knowledge of earlier cognitive research allows both an assessment and an appreciation of contemporary work.

In the case of other psychologists, personal circumstances rather than geopolitical events altered their careers. J. B. Watson, the founder of behaviorism and a former president of the APA, was forced to resign his university position and exile himself from psychology because of a scandal in his private life (Chapter 12). His successor within American psychology was B. F. Skinner. Skinner's acknowledged influence on psychology is based on his experimental research and innovative applications of psychological knowledge (Chapter 13), but he also has a broader reputation and influence. Indeed, a 1970 poll numbered Skinner among the 100 most important people in the world (Robinson, 1970). For this broader audience, Skinner is the arch-behaviorist and master controller of behavior. These were the roles Watson played during his brief career. What, then, would Skinner's role have been had Watson remained active in psychology throughout his life? Any answer would be speculative, but

[3] In the witty and irreverent *Devil's Dictionary,* a historian is defined as "a broad-gauge gossip" (Bierce, 1958, p. 57).

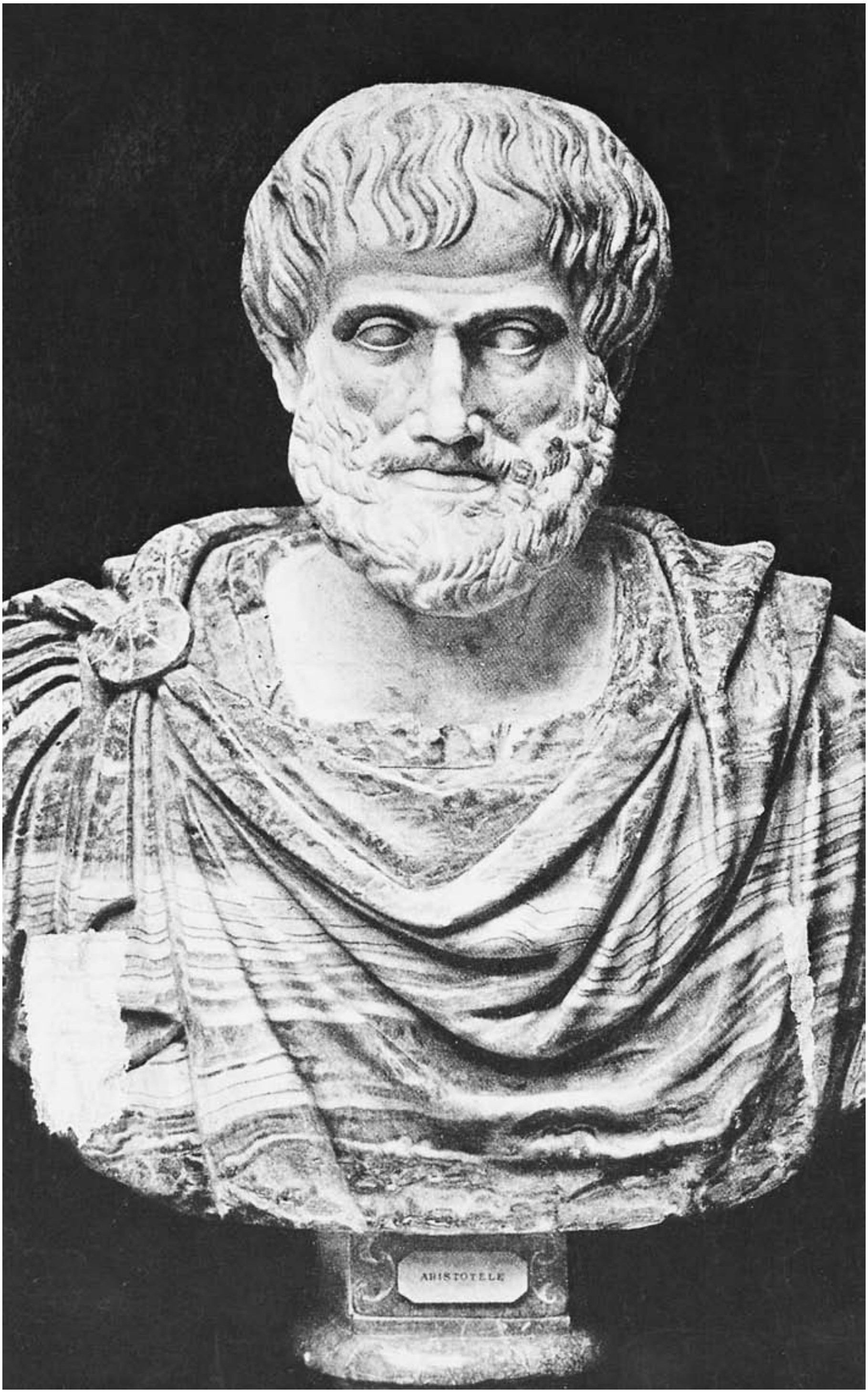
surely Skinner's career and perhaps even his contributions to psychology would have been different.

These examples illustrate this book's approach to the history of psychology. We will trace the development of psychological systems within their social and political contexts, but we will also examine the effects of events in individual psychologists' lives. In this way, we will be able to examine not only the historical context in which these individuals worked, but also how personal motivations, private tragedies, and chance good fortune affected their work. By focusing on these individual aspects, we will get a more complete picture of *why* they made the contributions they did. For instance, Sigmund Freud (Chapter 8) maintained his position of leadership of the emerging psychoanalytic movement as much from an imperative to dominate and lead as from a commitment to the development of his theoretical system or methods of treatment. Alfred Binet was strongly motivated to contribute to psychology and codeveloped the first intelligence test (Chapter 11). His work was clearly a form of self-rehabilitation and an attempt to compensate for the flawed research he did earlier in his career. Clark Hull (Chapter 13) dedicated his life to showing that though he was a man "who walked with a limp," he was as good as any man and could make contributions to psychology that would "stand the test of time." In his research on hypnosis and his development of a behavioral system, Hull achieved his goal.

At times, strong, dogmatic personality characteristics have worked against individual psychologists. Edward Titchener (Chapter 5) did much to establish psychology as an independent science in the United States, but his rigid insistence that his was the only true psychology and his aggressive criticisms of all attempts to apply psychological knowledge actually impeded the development of psychology. Toward the end of his career, Titchener withdrew completely from the field as it became apparent that his hopes for a "pure psychology" would never be fulfilled. Titchener's disappointment is not unique among the historical figures of psychology. Freud was ridiculed when he returned to Vienna and described his views on hypnosis and hysteria (Chapter 8). Ivan Pavlov was urged by one of the leading physiologists of his day, Sir Charles Sherrington, to abandon his experiments on classical conditioning and return to "real physiology" (Chapter 12). Edwin Twitmyer (Chapter 12) described classical conditioning experiments contemporaneously with Pavlov, but saw his reports completely ignored. Kurt Lewin (Chapter 7) and Hugo Münsterberg (Chapter 5) never received the recognition from their contemporaries or the place in psychology's history they clearly deserve, possibly because they were Europeans who never quite became a part of American psychology or society. How changed the history of psychology might have been if the lives of these psychologists had been different.

In this *biographical* account of the history of psychology, we will also see the effects of good fortune—the good fortune to have an inspiring teacher or to read the right book at a crucial stage in one's career. William James's *Principles of Psychology* (Chapter 10) inspired a whole generation of psychologists. For others, the happy accident of being in the right place at the right time furthered their careers. Max Wertheimer interrupted his summer vacation plans, got off a train in Frankfurt, and them met Wolfgang Köhler and Kurt Koffka (Chapter 7). Together they formed the great triumvirate of Gestalt psychology. Robert Yerkes, a student of animal behavior, was president of the APA in 1917 when the United States entered World War I, so he was chosen to organize psychologists' contributions to the war effort. As a result, Yerkes directed one of the most ambitious psychological testing programs ever conducted, the Army Testing Program (Chapter 11).

Despite such seemingly chance events, history is not chaotic, random, or entirely serendipitous. All these psychologists, and many of the others whose careers and contributions we will consider, were prepared by intellect, motivation, and ability to take advantage of their fortunate circumstances. The ways in which they did so alert us to the importance of similar opportunities in our own lives.



Aristotle.
(Culver Pictures)

CHAPTER 1

Psychology and the Ancients

The roots of Western civilization can be traced to the ancient worlds of Greece and Rome. In particular, two major areas of human inquiry—philosophy and natural science—originated in the work of ancient Greek and Roman thinkers. Since psychology emerged as an independent discipline from philosophy and gradually adopted the methods of the sciences, it is appropriate to examine the ancient foundations of its two parent disciplines.

Among the earliest accounts of phenomena we would call psychological are a series of Assyrian "dream books" composed on clay tablets in the fifth and sixth millennia B.C. (Restak, 1988, p. 3). Assyria was one of the great empires of the ancient world, stretching at its peak from the Mediterranean Sea in the west to the Caspian Sea in the east, between modern-day Armenia and Arabia. Clay tablets were not designed for easy reading. Wedge-shaped indentations in the clay represented syllables, not letters, and the same sign often represented two or more different sounds. But clay tablets had one great advantage: Fire only hardened them, so they often survived when a "library" burned (Casson, 2001). Assyrian clay tablets describe dreams of death and of the loss of teeth or hair and—most interesting of all, since they show self-knowledge—dreams about the shame of finding oneself naked in public. But our most complete knowledge comes from the ancient worlds of Egypt, Greece, and Rome. There ancient physicians and philosophers speculated about the nature and locus of the mind, sensation and perception, memory and learning. More generally, the ancients provided us with a number of different ways to view human nature and to approach the problems of psychology. These different approaches, or intellectual orientations and paradigms, arose from advances that the ancients made in mathematics and philosophy as well as from their conceptions of the nature of the universe.

ADVANCES IN MEDICINE: A BIOLOGICAL APPROACH

At various times during its history, psychology has had a close alliance with medicine, physiology, and neurology. Psychological processes and behaviors were seen as having a biological basis. In fact, much of "psychology" during those periods would now be considered as falling within the field of medicine. For this reason, we begin with a brief consideration of early Greek medicine. The Greek physicians had theories concerning the locus of mind as well as how physiology may affect temperament.

Early Greek Medicine

Before 500 B.C., Greek medicine was in the hands of priests who resided in temples and were believed to know the secrets of Asclepius, the Greek god of medicine (Magner, 1992). In the *Iliad,* Homer describes Asclepius as the son of Apollo, a heroic warrior and blameless physician. His followers, the Asclepiads, were reputed to be able to overcome infertility, to cure various illnesses and restore health, especially in cases of blindness, deafness, and various forms of paralysis. They boasted that all were cured, perhaps because they carefully selected their patients. Their techniques were closely guarded secrets. A patient who desired treatment was socially isolated ("incubated") in the temple and subjected to a variety of rituals. The priests recounted the powers of Asclepius, read case histories written on the temple walls, and made powerful suggestions that a cure would occur. Drugs were used to relieve pain and to stop bleeding. Finally, the patient would pay a substantial fee to the priests for their services.

Around 500 B.C., a Greek physician named Alcmaeon began to dissect the bodies of animals to study their skeletons, muscles, and brains. Earlier descriptions of the body existed, but Alcmaeon's were probably the first to be based on objective observations. He taught his methods to students at a medical school he established in his hometown of Croton, hoping to counter the influence of the priests and replace templar medicine with a rational, nonmystical, observational approach to illness. This approach was holistic in nature, as Alcmaeon believed that health and disease are the product of a respective balance or imbalance in the body's systems. In Alcmaeon's view, excessive bodily heat causes fever, excessive cold causes chills; health is a harmonious balance of bodily states.

Hippocrates

Alcmaeon's successor, Hippocrates, was the most important figure in Greek medicine during this period. Born around 460 B.C., he traced his ancestry back to Asclepius on his father's side and to Hercules through his mother. Hippocrates received his early education at Cos, one of the great centers of templar medicine. Like Alcmaeon, he came to reject the mystery and superstition of the priests and founded a medical school to teach others an uncompromisingly objective approach to medicine. So passionate was Hippocrates that he was even accused of burning down the medical library at Cos to erase competing medical traditions (Magner, 1992, p. 66). Hippocrates taught his students that all disease results from natural causes and must be treated using natural methods. He insisted that the healing power of nature allows the body to heal itself and rid itself of disease. Consequently, Hippocrates believed that the physician's first responsibility is to refrain from interfering with this healing power; the physician must first do no harm. Hippocrates, like Alcmaeon, adopted a holistic approach to medicine. Because he believed the body must function in a harmonious state, Hippocrates often prescribed rest, exercise, improved diet, music, and the association of friends to restore the body's natural harmony. Hippocrates' emphasis was upon the patient rather than the disease. His holistic approach to health and healing has ardent advocates in our time (Cousins, 1979, 1989).

Hippocrates, an acute observer, was able to draw some remarkably accurate conclusions from his observations. He concluded correctly that the right side of the body is controlled by the left side of the brain, and the left side of the body by the right side of the brain. This insight, which is counterintuitive, resulted from Hippocrates' observation that injury to one side of the head often produces paralysis of the opposite side of the body. More evidence of Hippocrates' observational skills can be found in the case notes and clinical procedures he detailed in a work entitled *The Art of Healing.* In this treatise, he presented clear descriptions of melancholia, mania, postpartum depression, phobias, paranoia, and hysteria. Hippocrates was mistaken about hysteria, however, as he restricted the disease to women, thinking it was due to wanderings of the uterus. This misconception of hysteria as a sex-linked illness persisted until Freud challenged it early in the twentieth century.

In his treatise *The Nature of Man,* Hippocrates presented a theory of humors. Empedocles had described the universe as composed of four unchangeable but intermingling elements: air, earth, fire, and water. According to Hippocrates, these elements form four basic humors in the body: black and yellow bile, blood, and phlegm. An imbalance or excess of any of these humors produces disease or illness. Phlegm collects in the nose and throat when one has a cold; when the skin is broken, blood is released; bile is excreted from the body following a serious wound. Hippocrates' theory of humors influenced the diagnosis and treatment of disease for many centuries. Bloodletting to vent excessive blood was practiced well into the nineteenth century. The red-and-white-striped barber's pole still seen today was originally the sign of a bloodletter.

Hippocrates' basic humors also were thought to affect temperament and personality. Individuals with too much black bile would be ill-tempered, peevish, and possibly melancholic; individuals with too much yellow bile would be irascible, choleric, easily angered, and perhaps manic; individuals with too much phlegm would be apathetic, dull, and sluggish; individuals with too much blood would be overly cheerful, happy, and optimistic. The staying power of this theory is evident in the contemporary usage of words such as *bilious, phlegmatic,* and *sanguine* (from the Latin word *sanguis,* for "blood"). Like Hippocrates, we may also ask: "What sort of humor is Mr. X in today?"

Hippocrates' most important work, *De morbu sacro* (Concerning the Sacred Disease), described the dread disease of epilepsy. At the time, epileptic seizures were considered a result of direct, divine intervention. Men and women who were buffeted by powerful, uncontrollable forces during *grand mal* seizures suffered because the gods had taken away their minds. Belief in divine retribution posed an ominous problem: How could a person appease a pantheon of gods and goddesses, any one of whom at any time could intervene to strike that person down? Since the Greek deities were a notably capricious group, the problem was indeed serious.

Such fatalistic attitudes were countered by Hippocrates' natural view of epilepsy. The opening sentence of Sacred Disease shows his clear intention to break from such mysticism:

> It [epilepsy] appears to me to be in no way more divine, nor more sacred than other diseases, but has a natural cause from which it originates like other affections. Men think it is divine merely because they don't understand it. But if they called everything divine which they do not understand, why, there would be no end of divine things. (Hippocrates, cited by Zilboorg & Henry, 1941, pp. 43–44)

Hippocrates rejected earlier views of epilepsy, calling people who held them nothing more than "conjurors, putrefactors, mountebanks, and charlatans." He considered epilepsy a disease caused by the brain's disharmony and predicted that examination of the brain of an epileptic would reveal the cause of that person's illness. Hippocrates was optimistic that epilepsy might be cured by natural treatments.

The theory of thirst Hippocrates formulated is still considered partially correct by contemporary theorists of motivation. According to this theory, as we breathe air over the mucous membranes of the mouth and throat, they become dry and parched. These dry membranes give rise to certain sensations that we interpret as the feeling of being thirsty, and so we drink to relieve these sensations. The dry-mouth theory came to be widely accepted after being reformulated in the eighteenth century by Albrecht von Haller (1747) and Pieter Jessen (1751). It was not until 1855 that the great French physiologist Claude Bernard presented evidence which caused physiologists to question the sufficiency of Hippocrates' dry-mouth theory. Bernard found that if he implanted diverting tubes in the throats of horses so that the water they drank never reached their stomachs, they would continue to drink large quantities of water long after the mucous membranes of their throats had been bathed with water. Even though Bernard demonstrated that Hippocrates' dry-mouth theory did not provide a complete explanation of our motive for drinking, the theory still accords well with everyday experience, and its persistence is found in such statements as "I need a drink, my throat is parched" and "I need to slake my thirst."

Hippocrates, "the father of medicine," has become almost a mythical figure, perhaps even a composite of the ideal physician's qualities. For centuries he was regarded as an authority on medical matters, and today medical students qualifying as physicians take the Hippocratic oath. But Hippocrates might also be regarded as an ancient "father of psychology." He described natural causes of psychological conditions, recommended holistic treatments, presented the first clear descriptions of many behavioral problems, and formulated long-lasting theories of temperament and motivation. Hippocrates was also an enlightened critic of laws prohibiting women from studying medicine. He pointed out that women were often reluctant to discuss their medical problems with a man and would be more likely to consult a woman physician.

Our knowledge of Hippocrates can be traced largely to the work of a Greek physician, Galen, who lived some 600 years after the time of Hippocrates. As Daniel Robinson (1981, p. 130) comments, not only did Galen keep the Hippocratic system alive for subsequent historians, he also kept the idea of the critical importance of observation alive for subsequent scientists.

Galen: A Link with the Past

Galen lived from A.D. 130 to 200. He left a great system of physiological ideas derived both from the works of his predecessors and from his own experiments and observations. His system influenced biological thought until the sixteenth century and the beginning of the modern scientific era. Galen was trained as a physician and anatomist at the Museum and Institute of Alexandria. That great institution of learning and research, with its 700,000-volume library, had been established in 323 B.C. after the death of Alexander the Great (356–323 B.C.) and the division of his empire. The museum's staff included the mathematicians Euclid (330–275 B.C.) and Archimedes (287–212 B.C.) as well as many skilled anatomists whose knowledge of the human body derived from their systematic dissections of human cadavers. In A.D. 169, Galen moved to Rome and took an appointment as the court physician of the Roman Emperor Marcus Aurelius Antonius. As such, Galen had access to the Imperial Library's vast collection of texts sent to Rome from all corners of the empire. Believing that all knowledge derives from ancient wisdom, Galen made good use of these texts. However, he was also committed to personal observation and experiment, and so his works report both the wisdom of his predecessors and his own empirical findings.

Between A.D. 165 and 175, Galen wrote a seventeen-book treatise, *De usu partium* (On the Usefulness of the Parts), describing the structure and functions of the body. In addition to the anatomic literature, Galen drew upon three lines of evidence: what he had learned from the ancient anatomists; his own clinical experience as surgeon to the gladiators of his hometown of Pergamum; and finally, his dissections of small apes, goats, pigs, cattle, and possibly some human cadavers, though the latter would have been done surreptitiously since dissection of the human body was illegal in Imperial Rome.

Although he was not a Christian, Galen was a vigorous opponent of the atheistic materialism of the ancient atomists and mechanists. He found their belief that all matter is the result of purely chance encounters between hypothetical atoms totally unacceptable since it ignored what seemed a fundamental fact his anatomic studies revealed: evidence of divine design in the structure of the body. Galen stressed that the intricacy, harmony, and beauty of the body could not have been an accident. He claimed to have shown that no part of the human body is superfluous. For instance, he noted that it is no accident that we have two hands. If we had but one, we would be unable to do many of the things we can easily do with two; if we had three, one would be superfluous. If we did not have a thumb, we would be unable to oppose the thumb and forefinger and thus would be incapable of the exquisite manipulation our hands allow. Galen cited the impossibility of conceiving of a substitute for any part of the body that would perform all the normal functions of that part as further evidence of divine design. What substitute, for instance, could be as versatile as the human hand?

Galen's notion of the improbability of creation without divine design has been elaborated throughout the ages. In the eighteenth century, the Archbishop of Canterbury, John Tillotson, applied Galen's idea to the creation of poetry, prose, books, and portraits (Bennett, 1977). How often, Tillotson asked, might a person have to take a bag of letters, shake it vigorously, and cast the letters on the ground before creating a poem or a prose passage? How often before the letters formed a book? How often might colors be sprinkled on a canvas before they made a portrait? Poems, prose, books, and portraits are assembled only when human intelligence is applied; so too, Tillotson argued, divine intelligence must have been applied in the creation of human beings and the world. Such views have perpetuated through the ages Galen's notion of our spiritual nature.

Galen's descriptions of the functions of the heart also reflect his spiritual approach to an understanding of humankind as well as his learning in Alexandria. The museum's anatomists noticed that a person's breath is warm and that warmth in general characterizes a living body, whereas chill characterizes a dead one. They thought that this warmth was created by a fire in the heart; they considered the breath seen on a frosty morning the fire's smoke. To test their theory, the museum's anatomists sacrificed slaves, rending open their chests in search of the biological flame. When they did not find it, they concluded the chests had not been opened fast enough, so there had been time for the fire to go out. Galen believed that the heart's biological flame distilled from the blood the spiritual substance responsible for movement and sensation: the vital spirit. He failed to recognize the heart's role as a pump, a recognition that was in fact delayed some 1,500 years until an Englishman, William Harvey, proposed the idea (Chapter 2).

Galen also described a method for "recognizing and curing all diseases of the soul" in his treatise *On the Passions and Errors of the Soul* (Hajal, 1983). Galen believed that diseases of the soul arise from passions such as anger, fear, grief, envy, and violent lust. Such passions, according to Galen, are governed by an irrational power within us that refuses to obey reason. To free oneself from such passions, a person must strive for understanding and self-knowledge. But that task is difficult because self-love blinds us to our own faults and causes us to see only the faults of others. Galen asserted that a good and noble mentor-therapist is essential. He wrote:

> If [a person] wishes to become good and noble, let him seek out someone who will help him by disclosing his every action which is wrong. . . . For we must not leave the diagnosis of these passions to ourselves but we must entrust it to others. . . . This mature person who can see these vices must reveal with frankness all our errors. Next, when he tells us some fault, let us first be immediately grateful to him; then let us go aside and consider the matter by ourselves; let us censure ourselves and try to cut away the disease not only to the point

> where it is not apparent to others, but so completely as to remove its roots from our soul. (Galen, quoted by Hajal, 1983, pp. 321–322)

This passage stands today as a description of an ideal relationship between therapist and patient or counselor and client.

Galen's works were not superseded in antiquity, and Galenism dominated medicine until the time of the Renaissance. Even during the great scientific revolutions of the decades following the Renaissance, most medical texts, especially those on anatomy, began with an acknowledgment of Galen. Most important, it is largely through Galen that we know of ancient scientific and medical theory. His contributions were celebrated in 1986 at the Third International Galenic Symposium at the University of Pavia.

ADVANCES IN MATHEMATICS: THE SEARCH FOR ORDER

The ancient Egyptians were indefatigable measurers and counters, but theirs was a practical approach. To levy taxes on land fairly, they needed accurate measures of the increases and decreases in the area of land caused by periodic flooding of the Nile. Geometry, the measurement of the earth, was developed to meet that need. In addition, the Egyptians were concerned with matters such as determining the north-south and east-west axes for the correct alignment of a temple and the measurements and calculations involved in the construction of such colossal structures as the pyramids. These were major achievements, but it was the Greeks who used the mensurative techniques perfected by legions of Egyptian geometricians and surveyors as the basis for mathematical theory.

For the Greeks, numbers were something more than a useful tool to summarize and describe measurements. With them, mathematics first became something more than a useful tool: It became the language of science and also shaped the world-views of men and women educated in the Western tradition (Grabiner, 1988, p. 220). Mathematical theory could also be used to predict future events. Thales of Miletus played an important role in this development. In 585 B.C., using mathematical theory, he predicted a solar eclipse. This awe-inspiring feat won him great popular acclaim but also fixed in the public mind the still popular idea of absent-minded scientists with their heads in the clouds unable to see things on the ground: Thales, it was said, fell into a ditch while contemplating the stars. An old woman asked: "How can thou know what is doing in the heavens, when thou seest not what is at thy feet?" (Turnbull, 1956, p. 81).

One of Thales' pupils was Pythagoras (584–495 B.C.), the Greek mathematician who gave us the Pythagorean theorem. It is not surprising that Pythagoras understood the power of prediction and sought to extend it to the psychological world. He was able to describe elegantly a mathematical relationship between the physical world and the psychological experience of harmony. Pythagoras demonstrated that when a single, stretched string of a musical instrument such as a harp or lute is plucked, it produces a ground note; when divided into two parts, four parts, or any other exact division and plucked again, it produces notes that are harmonious with the ground note. When string divisions are made at points other than exact divisions, the notes are not harmonious with the ground note. Pythagoras had shown that notes pleasing to the human ear correspond to exact divisions of the instrument's strings. Having defined the relationship between the length of a lute's string and the experience of musical harmony, Pythagoras was able to predict the quality of musical experience for any combination of strings. Successes such as these led Pythagoras to conclude that all is number, that the principles of mathematics are the principles behind all things.

Pythagoras' conclusion had wide appeal. His lectures and demonstrations attracted large, enthusiastic audiences, including many women who ignored a ban on their attendance at public meetings. His followers went so far as to organize themselves into a secret society, the Order of Pythagoreans, dedicated to using their knowledge of mathematics to understand their world and eventually influence it.

The academic tradition surrounding Pythagoras and the early Greeks also spawned Western science and influenced Western philosophy and, much later, psychology as it struggled to define itself as a science. Psychologists still attempt to "measure" complex psychological processes such as motivation, creativity, and intelligence. If precise relationships could be found between such phenomena and numbers, might it be possible to delineate psychological laws in the same way we have established the physical laws of the universe? Might it be possible to predict human behavior and thinking processes with the same accuracy with which the ancient Greeks predicted the movements of the heavens? Psychologists still debate this possibility.

ATOMISM: THE MIND AS MATTER

Between the seventh and fifth centuries B.C., the Greeks were concerned with theories of the cosmos, or cosmology. This area of inquiry resulted in materialism, or the position that the universe can be understood in terms of the basic units of the material world. It was from this intellectual tradition that Democritus (460–370 B.C.), the great philosopher of Thrace, developed atomism.

Democritus and an Ancient Theory of Perception

Democritus thought that tiny atomic particles in ceaseless motion are the basis of all matter. He saw the world as a mass of such atoms that ran itself without need of outside forces. The human mind was not excluded from this physical world. It, too, was a collection of atoms which could influence and be influenced by events in the external world. Consequently, Democritus considered the mind's contents, as shown by its arrangement of atoms, to be the result of experience. It is important to note that this theory differed substantially from later conceptions of the mind, such as that of Descartes, who felt the mind was separate from the body and was governed by laws different from those governing the physical world.

Democritus believed that objects in the external world emit beams of atoms that impinge upon the mind of the perceiver to produce perceptions. The atomic beam is a representation of the object: a rectangular object emits a rectangular beam; a circular object, a circular beam; a sour-tasting object, a beam of angular, small, thin atoms, and so on. Icons in the brain represent perceived objects. Not until neuroscientists made relatively recent discoveries of the functional anatomy of the brain and the central nervous system was this notion of iconic representation completely abandoned.

Zeno's Paradoxes

According to M. Cary and T. J. Haarhoff (1959), the general problem of the relationship between mind and matter became important as the Greeks began to question the reliability of the sensory systems. Zeno of Elea (495–435 B.C.) offered the strongest support for this position. Zeno invented subtle puzzles and paradoxes to demonstrate the inadequacy of the senses, especially in the perception of motion. The most famous of Zeno's paradoxes centers on an imaginary race between Achilles and a tortoise. Zeno always gives the tortoise a head start, so as soon as Achilles reaches the place where the tortoise began, the tortoise has moved to a new point; as soon as Achilles reaches that point, the tortoise has moved a little farther, and so on. Even though Achilles is the "fleetest of all men," he will never win the race. According to Douglas Hofstadter (1979), Zeno hoped to use his paradox to show that "motion" is impossible, and that only in the mind does it seem possible. Motion is a perceptual illusion.

A contemporary version of one of Zeno's paradoxes asserts that you will never leave the room you are in (Rucker, 1983, p. 84). To reach the door, you first must move half the distance between you and the door. But you are still in the room, so to reach the door you again move half the remaining distance, and so on . . . in a series of moves of

$$1/2 + 1/4 + 1/8 + 1/16 + \ldots\ldots$$

the original distance. The obvious solution is to claim that the sum of the infinite series is 1, and so you reach the door. The paradox is that if you always move half the distance to the door, you will never reach it.

Zeno's paradoxes challenged the notion perpetuated by atomism and materialism that human thought processes and the soul can be understood in terms of the laws of the physical world. As Cary and Haarhoff (1959) stated, under these new influences the Greek thinkers came to decide that "man is the measure of all things" and that therefore "the proper study of mankind is man." This "humanistic tendency" set the stage for advances in philosophy.

ADVANCES IN PHILOSOPHY

The three major philosophers who grew out of the humanist tradition were Socrates, his pupil Plato, and Aristotle. These great thinkers established epistemology, the branch of philosophy that investigates the origin, nature, methods, and limits of human knowledge. They were also concerned with several psychological issues, including learning, memory, and conscious awareness.

Socrates (469–399 B.C.)

Socrates has been portrayed through history as a great observer and skeptic. For Socrates, the unexamined life is not worth living. He sought knowledge everywhere—in the streets, the marketplace, the gymnasium, and the countryside—intensively questioning people. He asked: What is truth? What is justice? What is courage? and rigorously examined the answers, pointing out logical flaws and poor or inadequate reasoning. Socrates questioned every assumption, doubted the obvious, and ridiculed cant and pretension. He expected that his logical, rigorous approach would produce true answers to these and similar questions. His approach was that of a rationalist.

Fundamental to Socrates' philosophy of education was his belief that truth cannot be defined by an absolute authority but rather lies hidden in every mind. A teacher's role is to uncover this dormant truth; the teacher thus might be compared to a midwife, who has no part in the implantation of the sperm that fertilizes the ovum but is responsible for assisting in the baby's delivery. So too, according to Socrates, the teacher's role is not to implant truths in the pupil's mind, but rather to assist in their emergence. To facilitate learning by discovery, Socrates devised a teaching method analogous to his street dialogues. The teacher asks a series of questions designed to lead the pupil to truth by illustrating flaws in the pupil's reasoning. In this Socratic method, teaching is a partnership between pupil and teacher rather than a superior-subordinate relationship. Socrates rejected fees for his instruction and lived a life of simplicity and moderation.

To demonstrate the power of this method, Socrates led an untaught boy who had no knowledge of geometry to discover for himself the theorem of Pythagoras (Lamb, 1967, pp. 303–311). Socrates claimed that he had not taught this theorem to the slave but had facilitated its emergence from a dormant state in the slave's mind. One of his contemporaries, Antiphon, treated those who suffered from grief and melancholy using a Socratic dialogue of questions and answers. Antiphon has been called the first psychotherapist (Walker, 1991, p. 5).

As a result of the power of his arguments, Socrates was often able to discredit answers given to his questions concerning definitions of truth, justice, and courage. It is not surprising that he made many enemies. After all, we believe that we know what truth, justice, and courage are. It is embarrassing and annoying to be shown that perhaps we do not. Eventually his fellow citizens tired of his behavior, and so at the age of 70 Socrates was charged with undermining the religion of the state and corrupting youth. He was tried in front of 501 jurors and, by a margin of 60 votes, was found guilty and sentenced to death. Socrates accepted the verdict as legitimate though unjust, spent his last minutes comforting friends, then drank hemlock poison.

Plato (427–347 B.C.)

Plato was Socrates' pupil and successor. In fact, much of what we know of Socrates comes from Plato's record of their dialogues. Plato founded an academy in Athens, a society of scholars and students that lasted for 916 years. His aim, like that of Socrates, was not to give his students a collection of facts, but rather to train them to see below the surface of things, to seek the eternal reality underlying all. However, this task was a difficult one, for like Zeno and Socrates, Plato acknowledged the unreliability of sensory information. Knowledge does not derive from sensations, which are sometimes misleading, but from the processes of reasoning about sensations.

Plato stressed the difference between sensations deriving from our senses and what he called "Forms," the eternal structures that order the world and are revealed to us through rational thought. Plato considered Forms to be suprasensory, transcendental, with an existence independent of the sensations that constitute them. Sensations corrupt, decay, and die; they are unstable. Plato's "Forms" are more real and permanent. To illustrate this distinction, Plato used an allegory of being in a cave, chained in such a way that all one can see of objects outside the cave are shadows cast by the flickering flames of a fire. The shadows are the analogue of sensations; the real things outside the cave are the "Forms." Our world of sensations is for Plato a world of dancing, flickering shadows of which we can never be sure.

For Plato, the only way to increase the accuracy of our knowledge of the world is through measurement and deductive reasoning. He was well aware of the contributions of Pythagoras and, like him, sought to describe the world using mathematical principles. Over the entrance to his lecture hall at the Academy, Plato inscribed the words "Let no one destitute of geometry enter my doors." When one of his students asked, "What does God do?" Plato replied, "God always geometrizes." Plato called geometry "knowledge of that which always is"—knowledge of the "Forms" created by God. Human geometricians could measure the earth, but what of the human psyche? Could it, too, be measured? Pythagoras had shown that some aspects of human psychological experience could be measured. Plato suggested others. He recognized that people differ in their skills, abilities, talents, and aptitudes, categorizing them as individuals of gold, silver, brass, or iron. Society must recognize these individual differences and what Plato saw as their inevitable consequence: some must rule, while others serve. In *The Republic,* Plato described a utopian society with an oligarchical system of government in which a small number of people endowed with superior reason, the Guardians, ruled under a philosopher-king. Those with superior courage would be warriors; those with a superior sense of beauty and harmony would be artists and poets; those with little talent or ability would be servants and slaves. Plato believed that such differences came from the gods, and that society must select and preserve needed qualities through prearranged marriages and controlled breeding. His position was avowedly *nativistic* in that it assumed a hereditary basis for human characteristics and intelligence. But how could such qualities be measured? Plato believed that these qualities are localized in different parts of the body: reason in the head, courage in the chest, and appetite in the abdomen. His was a bodily phrenology without the exaggeration of later phrenologies (Chapter 3). By proposing to assess individual differences by measuring different parts of the body and then assigning people to various tasks based on their psychological strengths, Plato anticipated the modern field of psychometrics.

Aristotle (385–322 B.C.)

Aristotle, the last of the three major Greek philosophers, is accurately described as more of a natural scientist than his two predecessors. As a young man he lived in Athens and was a devoted student of Plato for some twenty years. In his middle years he was forced, because of his politics, to leave Athens, and he spent years traveling, working for a time as a tutor to the boy who later was to become Alexander the Great. He returned to Athens at the age of 40 and founded a school of philosophy and science at Lyceum. It was during his years there that he wrote most of his important works on biological and psychological topics.

Aristotle is of interest to us because he was one of the first Greek philosophers to complement deduction with an inductive, observational approach to his work. As mentioned earlier, Zeno pointed out the unreliability of our perceptions. Zeno's contemporary, Thales, stressed to his pupil Pythagoras the importance of using deductive methods to uncover the truth. Socrates also relied on logical proof to uncover truth in the minds of his students. Finally, Plato contended that our sensations are but imperfect representations of reality, not to be trusted. In contrast to Plato, Aristotle saw the value of mathematics not as providing knowledge of eternal Forms, but rather as making logical deductions from self-evident assumptions and clear definitions. In his *Posterior Analytics,* Aristotle advocated the reduction of all scientific discourse to syllogisms—logically deduced explanations from first principles. His famous law of the lever was not based upon experiments with weights, but rather derived from postulates such as "equal weights balance at equal distances." But Aristotle also recognized the importance of careful observation. After all, the world may not run as logically as Socrates and Plato assumed. If it does not, their conclusions, based on deductive methods, might not be entirely true. Aristotle came to some remarkably accurate conclusions using an inductive, observational approach, but as we will see, his methods of inquiry also led him to some interesting but false conclusions.

From his observations of his own cognitive processes as well as those of others, Aristotle developed basic principles of human memory that have been restated many times in the history of psychology and are still fundamental to many contemporary theories. In his treatise *De memoria et reminiscentia* (Concerning Memory and Reminiscence), Aristotle outlined his theory that memory results from three associative processes. Objects, events, and people are linked through their relative similarity to one another or through their relative difference—how much they contrast with one another. Things are associated if they occur together in time and space. These three basic principles of association—similarity, contrast, and contiguity—were supplemented by two other important influences on the strength of a particular association:

1. *Frequency.* Aristotle held that the more often a particular experience is repeated, the better it will be remembered. In many twentieth-century theories of learning, the relationship between the number of times a habit is reinforced and its strength and retention is a central tenet.
2. *Ease.* Aristotle also recognized that some associations form more easily than others, and some events are more easily remembered than others. Modern studies of learning and memory have clearly demonstrated that certain associations are more easily formed and remembered than are others.

Memories are particularly important because they reflect our experiences of the world. Experiences, in turn, are responsible for the contents of the mind; without experience, our minds would be blank. The mind at birth has the potential for thought, but for this potential to be realized, the world must act upon it. The mind, for Aristotle, is furnished by experience, just as a writing tablet is filled with letters. Aristotle adopted the position of an *empiricist,* positing that all the ideas we have, including those sometimes considered innate or inborn, are the result of experience. His position anticipated that of John Locke and other empiricist philosophers (Chapter 2), and through them he influenced the materialistic *behaviorist* psychology of John Watson (Chapter 12). Aristotle's metaphor of the mind at birth as a blank tablet is the first of many different metaphors of mind in the history of psychology. Others include the mind as a giant clock, a ghost, an elaborate telephone switchboard and, most recently, as an information processing machine or neural computer. Leary (1990) describes these and other metaphors of mind and argues that they have been especially important for psychology in contributing to theory construction, new ideas and concepts, research, and even to practical applications.

Aristotle also developed a sophisticated and influential analysis of causation, his theory of causes. To illustrate his views, Aristotle described examining a statue; let us follow his example by considering different causes of Michelangelo's David.

1. Upon examining the statue, we find that it was sculpted from a huge block of white, unflawed Carrara marble. It is a marble statue. That is a description of what Aristotle termed a *material cause.*
2. We also know that the statue is not just a block of marble, but has an essence or form. That is the *formal cause.*
3. How did the statue come to have that form? One answer might be through the strokes and blows of a sculptor's hammer and chisel. That answer describes what Aristotle called the *efficient cause.*
4. Finally, in describing the statue, we attribute it to the sculptor. It is Michelangelo's David. The statue is the product of Michelangelo's genius and supreme talent. That is what Aristotle called a *final cause.*

The concept of a final cause represents the teleological[1] aspect of Aristotle's analysis, which gives an appearance of certainty. Attributions of purpose are unacceptable in such sciences as physics—apples have no purpose in falling from trees, nor does water in boiling over a flame. But in psychology, teleological, purposive explanations—when used with caution and discretion as, for example, by Tolman in his Purposive Behaviorism (Chapter 13)—have proved useful.

Aristotle also held remarkably perceptive views on psychological catharsis. In his *Art of Poetry*, he described drama as sometimes arousing emotions that have a purgative effect on the audience. In the twentieth century, Sigmund Freud was to make *catharsis* a central concept in his psychoanalytic theory. Today the Aristotelian view of *catharsis* is often heard in the debate about the effects of media violence on the tendency to behave aggressively. Some authorities, together with media executives, argue that exposure to movie or television violence can be beneficial as it allows viewers to purge themselves of hostile or aggressive impulses—a *cathartic* response. On the other side of the debate, equally prominent authorities argue that some individuals are led by such portrayals to behave aggressively, that filmed violence is a preparatory school for violence in our society, and that such consequences are especially likely in immature or emotionally unstable individuals.

Aristotle saw all life as forming a "ladder of creation," a continuous series of gradations from the lowest to the highest forms of complexity. He outlined three levels of life: nutritive (plants), sensitive (animals), and rational (humans). Thus linked, the whole of nature was to be studied. This conception of a scale of nature (*scala naturae*) has been a major influence on biological thought throughout the centuries. Charles Darwin, for example, in formulating his theory of evolution, acknowledged Aristotle's influence. Aristotle's conception of a scale of nature has not been entirely beneficial for psychology, since at times it has led to the belief that all animals, including humans, can be ranked on a scale of unitary, continuous, graded dimensions. Lovejoy (1936) pointed out that the notion of a scale of nature eventually led to more theological than scientific conceptions in which God was at the top of the scale and all other creatures were seen as increasingly imperfect copies of His perfection. Thus the angels were somewhat imperfect, humans more imperfect, apes still more imperfect, and so on "down" the scale.

One of Aristotle's most interesting misconceptions concerns the locus of the mind. As mentioned earlier, Hippocrates felt the brain was the seat of sensation, perception, and thought. Colin Blakemore points out that whatever scientific evidence is prominent at the time influences "intuitions" concerning the seat of consciousness:

> It seems inconceivable today that anyone could ever doubt that one's mind is in the brain. For me, the "me-ness" of me is undoubtedly situated in the middle of my head. But I am sure that I feel this with such confidence because I

[1] *teleology,* n. Philosophy: The doctrine that final causes exist (*Random House Dictionary of the English Language* [RHDEL], p. 1460).

accept the currently fashionable scientific evidence that this is so. (Blakemore, 1977, p. 9)

For Aristotle, the "currently fashionable evidence" led him, understandably, to a radically different conclusion: the lively heart is the seat of thought. For instance, Aristotle studied the development of the chick embryo and noted that the heart is one of the first organs to move. He also observed that while an injury to the head may produce a period of unconsciousness, the person often recovers, whereas a wound to the heart is invariably fatal.

Aristotle's contention that the heart and not the brain is the most important part of the body might also have been influenced by his knowledge of ancient Egyptian burial practices. The *Ba* spirit of an ancient Egyptian was not in the head, but in the bowels and chest. To preserve the body for its journey to Osiris, body parts such as the liver, stomach, lungs, and heart were extracted and embalmed in miniature coffins. However, there was no container for the brain, which was probably retracted through the nose with a spoon during embalming and then destroyed.

Careful observations and a knowledge of Egyptian history were not the only influences that prompted Aristotle to choose the heart as the locus of the mind. He might have been influenced by a model readily available to him from his everyday experience: the *Agora,* the central public meeting place in Greek towns. At the *Agora,* the town's citizens would meet to discuss and debate current events, politics, sports, religion, and local gossip. From these discussions common themes would sometimes emerge. To Aristotle, such themes were analogous to the thoughts that emerged from the mingling of sensations, images, and memories, or the s*ensorium commune* (seat of senses), of the heart. The brain's function, by contrast, was to cool the blood. This example is one of many we will find throughout the history of science and psychology that demonstrate how a shared world-view, characteristic of a particular historical period, influences the models philosophers and scientists use to illustrate their theories.

Some other interesting misconceptions that resulted from Aristotle's inductive methodology concerned his beliefs about animals. In his books *Historia animalium* (A History of Animals) and *De partibus animalium* (About the Parts of Animals), Aristotle attempted to classify animals on the basis of such characteristics as number of legs and presence of blood. He also described animal locomotion and parental and sexual behavior. Aristotle provided an accurate account of the behavior of foraging bees, but since he relied on the observations of others, he concluded bees do not make honey but rather collect it on their wings as it falls from the sky. He also noted that caged birds' beaks often grow long, which indeed they do, but he concluded that the growth is a punishment for being inhospitable to a guest in a previous world.

Aristotle's theories about the locus of the mind and animal behavior are examples of conclusions resulting from a preference for inductive methods that would have benefited from qualification through a rational critique. Even so, as we have seen, several contributions derived from Aristotle's inductive approach are echoed in contemporary theories of memory, catharsis, and evolution. Robinson (1989) goes further and argues that Aristotle's interest in psychological topics, and especially his major work *De anima* (On the Mind), are strong evidence for his having a formal psychology and thus being considered an ancient father of psychology.

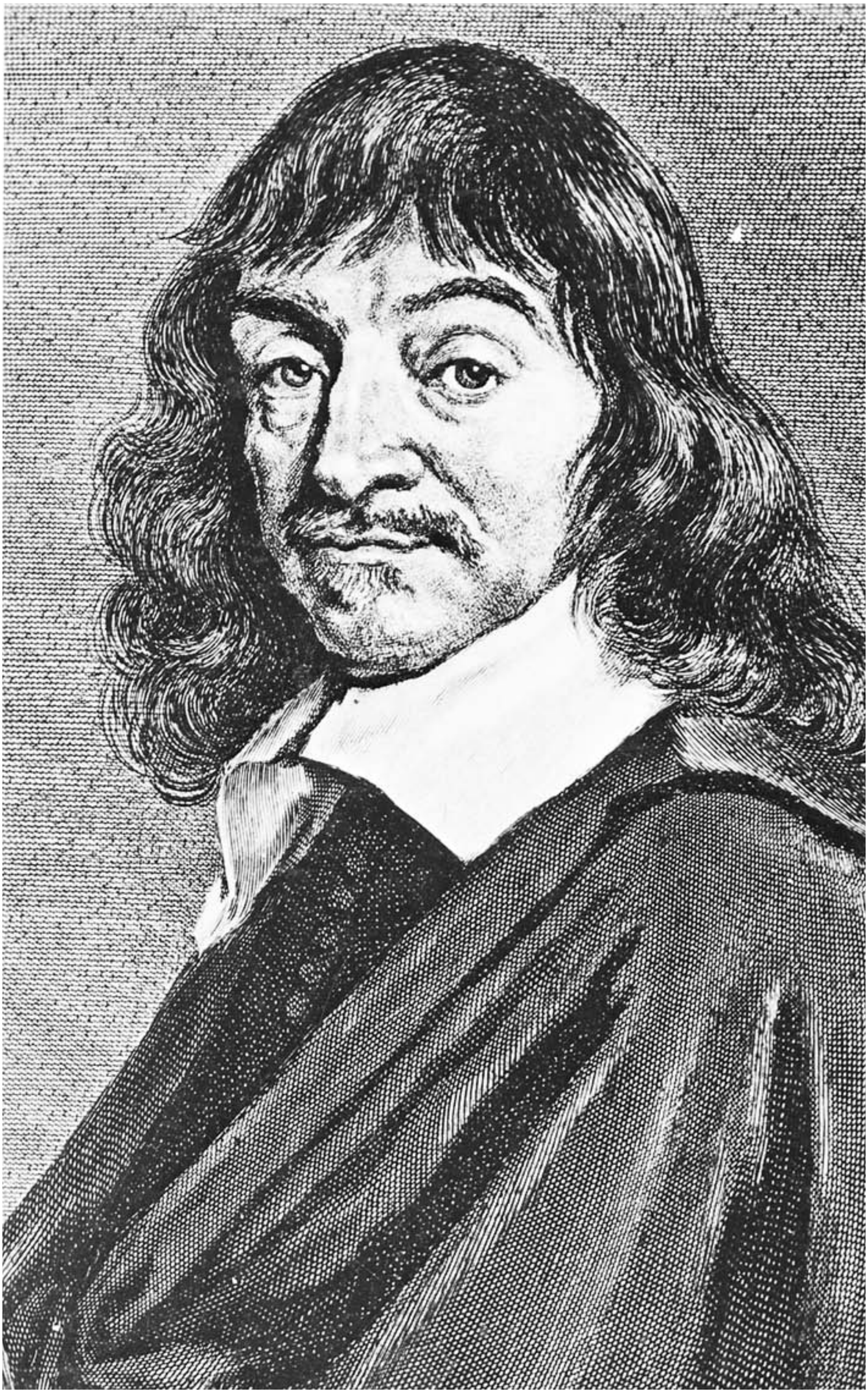
Post-Aristotelian Philosophy

A number of different schools of philosophy flourished for short periods in post-Aristotelian Greece, the most interesting of which, from a psychological point of view, were the Stoic school and the Epicurean school. The two gave radically different answers to such questions as "How are we to find happiness?" and "What should we do with our lives?" Both groups of philosophers aimed to develop all-inclusive philosophical systems applicable to physical phenomena as well as to political, social, and moral conduct and concerns. The leading Epicurean philosophers were the Greek Epicurus (341–270 B.C.) and the Roman poet Lucretius (99–55 B.C.), who asserted that all knowledge originates in sensations that are retained in memory. A very similar view was to be proposed in the seventeenth century by John Locke (Chapter 2). For the Epicureans, human life is a brief episode in the eternal history of atomic collisions. Theirs was a stochastic or statistical view of creation; they asserted that to consider the earth the only populated world is as absurd as to conclude that in an entire field sown with millet only one grain will grow. For Epicureans, the goal of life was to enjoy whatever pleasures are possible while minimizing the pain and suffering of others. Major Stoic philosophers were the Greek Zeno of Citium (336–265 B.C.) and the Roman dramatist Seneca (4 B.C.–A.D. 65). Stoics believed that a rational principle (*logos*) guides the universe and that each person has a duty to follow and promote reason in both personal conduct and affairs of state. Passions and emotions are to be subdued. The Stoics influenced Immanuel Kant (Chapter 2). In a memorable description, the American philosopher and psychologist William James (Chapter 9) called these philosophical schools "tender-" and "tough-minded," respectively.

THE IMPORTANCE OF THE ANCIENTS

Now that we have reviewed briefly some of the issues and questions that concerned the ancients, it should be evident that contemporary psychologists are still addressing those questions. Like Democritus, we still ponder the nature of the mind, and like Aristotle, its location. We attempt to describe behavior and information processing in terms of mathematical laws, just as Pythagoras attempted to define mathematical laws of perception. Like Galen, we ruminate about the nature of humanity. *Empiricist* and *nativist* views of the contents of the mind recur in the history of psychology. It is remarkable that such men as Aristotle, Plato, and Galen would find quite familiar many of the questions contemporary psychologists consider.

But the importance of the ancients lies deeper than these similarities alone. Why do we still ask the same questions as the Greeks and Romans? Is it only because we have not yet arrived at satisfactory answers? Not completely. Rather, it is because we share with the ancients a similar world-view, a view of the world which they defined. The European languages we speak are derived from Greek and Latin. Our systems of ethics emerged from ancient philosophy. Aristotle's inductive method and Plato's deductive approach underpin modern science. In fact, the importance of developing scientific theories at all—in order to be able to predict and control events in our world—was first recognized by the ancients.



René Descartes.
(The Bettmann Archive)

CHAPTER 2

Philosophical and Scientific Antecedents of Psychology

Nearly a thousand years passed between the final collapse of the Roman Empire in the fifth century A.D. and the beginning of the Renaissance. For several centuries, successive waves of barbarian tribes—the Ostrogoths, Visigoths, and Vandals—rampaged across Europe, occupying various sections of the shrinking empire and leaving death, destruction, and devastation in their wake. Roman law could no longer be upheld, and crude barter replaced the universal Roman monetary system. It is not possible to give a date for the "fall" of the Roman Empire, but by A.D. 476 the governance had fallen to Odoacer, the German "king" who deposed the last Roman emperor, Augustulus. *Sic transit gloria mundi* (Thus passes the glory of the world).

The early Middle Ages or Medieval Ages, from the beginning of the fifth century to around the year A.D. 1000, were formerly called the Dark Ages because of the eclipse of European civilization. But that depiction has been challenged by a number of scholars, including Kemp (1990), who paid special attention to *medieval psychology.* Kemp asserts that there was indeed a prescientific psychology as part of the advance of learning and the development of science allowed by the medieval Roman Catholic Church. Kemp also describes a medieval method of inquiry which, while it respected the ancients, did not unquestioningly accept their views. There were indeed scholastic, technical, and scientific contributions before, during, and immediately after this era. In the seventh century, stirrups were used for the first time to support a rider's foot; they allowed a rider to mount and maneuver a horse more easily and wield a weapon with greater force. The ninth century saw the publication of a major biography of the Emperor Charlemagne. The eleventh century *Doomsday Book* records nearly six thousand water mills operating in Britain. In 1180 the windmill was invented, an invention so successful that within ten years the Vatican levied a papal tax on all new windmill installations.

Psychological questions were often the province of religion. Saint Augustine, the Bishop of Hippo, lived in the fourth century. For Augustine, God was the ultimate truth, and knowing God was the ultimate goal of the human mind. But what of people? How are we to understand human actions and conduct?

Augustine recommended turning inward, believing that the truth dwells inside every person. In his *Confessions*, Augustine disclosed his emotions, thoughts, motives, and memories. At times his disclosures are startling, as when he candidly describes his passions and the temptations of a mistress. For this work of public disclosure Augustine has sometimes been called "the first modern psychologist" (Misiak & Sexton, 1966, p. 8). The label seems premature, but Augustine's *Confessions* is still of great interest for its analysis and description of one man's psyche. Others followed; in the seventh century, the prophet Mohammed firmly established Islamic civilization, and Muslim scholars and intellectuals preserved many of the works of antiquity. In the thirteenth century, Saint Thomas Aquinas reinterpreted Aristotle and firmly established scholasticism, the discipline that readmitted human reason as a complement to religious faith in the search for truth.

The twelfth century was a period of cultural and economic revival in Europe. The population grew, towns flourished, the merchant classes emerged, and feudalism[1] weakened as guilds, civic councils, and monastic chapters organized. One great legacy of the medieval period is Gothic architecture, especially the magnificent cathedrals of Europe. The late twelfth and thirteenth centuries saw the establishment of fourteen universities, beginning with the Universities of Bologna and Paris. English scholars would travel to Paris to hear lectures; but at the end of the twelfth century King Henry II banned such travel, so scholars began to gather in Oxford. Their numbers grew, and a series of clashes between the students and the townspeople of Oxford led to the foundation of the first Oxford College, Merton, in 1264. The first Cambridge College, St. Peter's, was founded in 1284. Students at those colleges, all of whom were men, were supposed to live a scholastic life under the supervision of a monastic master. Much of the ritual and pageantry associated with modern university life, including the hoods and academic robes worn when degrees are awarded, dates from those first universities. Eventually those institutions became vital to the development of science, but the century that followed their establishment was a time of terrible turmoil and strife. Barbara Tuchman (1979) described the "calamitous fourteenth century" as a time of civil war in England and France; nearly continual war between France, England, and Italy; mad popes and kings; lawless knights; debilitating taxation; and finally, the horrors of the black death (1348–1350), the plague that killed perhaps one-third of the population of Europe. This terrible century was followed by the rebirth of science, learning, art, and literature during the fifteenth and sixteenth centuries—the Renaissance. It is in the Renaissance world that we find the first formal philosophical and scientific antecedents of psychology.

THE RENAISSANCE WORLD

The Renaissance began in Florence, a beautiful walled city of 70,000 people on the banks of the Arno River in northern Italy. The most spectacular achieve-

[1] In feudal societies, social, economic, and political power lay in the hands of a small number of landowners.

ment of the Italian Renaissance was the work of artists such as Fra Angelico, Andrea Mantegna, Michelangelo Buonarotti, and Leonardo da Vinci. Leonardo was the quintessential Renaissance man: a brilliant artist and sculptor, an inventor, a skilled anatomist who made the first cast of brain ventricles, and a medical illustrator whose anatomic drawings were the first to give the observer more than one perspective of the subject. Leonardo's most celebrated anatomic drawing, a human embryo in the womb, was so expert it appeared in anatomy texts for hundreds of years.

The greatest technical achievement of the Renaissance was the invention of printing. The first printed manuscripts had appeared in China as early as the eighth century A.D. However, those books were block-printed; that is, the printer carved characters and figures by hand on the surface of wooden blocks, applied inks, and made a print. The British Museum has a number of those books and scrolls in its collection. The oldest is the *Diamond Sutra,* dated 868 A.D., in which the Buddha is interrogated as to the meaning and significance of life. The scroll is 35 feet long with both text and pictures, including one of the Buddha. It is clearly the product of a mature printing industry. But block-printing was time-consuming, laborious, and inflexible. Shortly before 1450, after much labor and many financial and technical difficulties, Johannes Gutenberg developed a method of casting movable type that could be used to print a number of books relatively cheaply (Man, 2002). In 1450, Gutenberg signed a contract for the "making of books," one of which was the Bible. Between 1450 and 1459, Gutenberg printed 185 *Gutenberg Bibles,* 48 of which exist today. The Library of Congess in Washington, D.C. has in its collection a perfect *Gutenberg Bible.* Printed in 1455 on vellum, a fine-grained parchment made from animal skin, it has double columns of crisp, clear type and 42 lines on a page. Acquired by an Act of Congress in 1930, the Bible is on public display in a sealed unit in the East Floor of the Thomas Jefferson Building of the Library of Congress.[2]

A less-than-exemplary use of this new technology occurred when the Church used movable type to mass produce indulgences, which were sold for the remission of the penalties of sin. By the end of the fifteenth century, printing presses had been established in at least thirteen European cities. For the first time, knowledge was available to a relatively large number of people, and scholars were able to publish their own works and read the works of others. By the time Columbus sailed in 1492, 20 million volumes had been printed in Europe (Foote, 1991).

The Renaissance was the era of Niccolò Machiavelli and William Shakespeare. In this period, in addition to literary volumes, the first books in many areas of knowledge, including prescientific psychology, were printed. A variant of the word *psychology, Psichiologia,* is the title of a work by Marcus Marulus published around 1520 (Brozek, 1999, p. 177). The first author to use the word *psychology* in a book title appears to have been Rudolf Goeckel (Lapointe, 1970). In 1590, he published a collection of works by different authors on the nature of humanity, particularly the human soul. The title of his book was *Psychologia hoc est, de hominis perfectione,* which might be translated literally as "Psychology this is, about the perfectability of man" or, more freely, as

[2] High-resolution digital images of every page are available on the **Octavio** website of the Library of Congress.

"Psychology on the improvement of man." This first psychology book was a success, going through three printings before the end of the century. The first psychology book in English was John Broughton's *Psychologia; or, An Account of the Nature of the Rational Soul,* published in London in 1703 (Van de Kemp, 1983).

During the Renaissance, knowledge of the geography of the earth expanded as never before. Portuguese navigators sailed fifteen hundred miles down the African coast and established a lucrative trade in gold, ivory, pepper, and slaves. The most lucrative trade routes led through Constantinople, the largest city in medieval Europe, to the East. When Sultan Mohammed II sacked that city in 1453, a sea route to the East became imperative. The first sea voyage to India transpired in 1497 when Vasco da Gama successfully rounded the Cape of Good Hope. Christopher Columbus sought a shorter route to the East by sailing west from Europe, but in 1492 he found the New World instead; and Ferdinand Magellan in 1519 rounded Cape Horn, proving once and for all that the earth is round and that the continents of Asia and America are separate.

It would seem that such an enlightened age might have given birth to psychology, the formal study of human beings. After all, the Renaissance was an era of exploration, discovery, and artistic achievement. Leonardo had made beautiful drawings of the human anatomy, but no one produced equally detailed studies of the mind during this era. The reasons why may become evident when we examine the reactions of the Renaissance theological community to the development of a very different science—astronomy.

RENAISSANCE SCIENCE

The Place of Human Beings in the Universe

During the Renaissance, conceptions of the cosmos and of the place of humans within it underwent drastic change. The change began in 1543, when Nicolaus Copernicus (1473–1543) published his heliocentric (sun-centered) view of the universe. Copernicus was a distinguished Polish cleric, humanist, and astronomer. After many years of astronomical observations, he concluded that the geocentric (earth-centered) view of the universe originally formulated by Ptolemy in the second century A.D. was incorrect. According to Copernicus, it is the sun, not the earth, that sits at the center of the universe and around which the planets orbit. The daily rising and setting of the sun, he said, is due to the earth's rotation on its axis, and the annual progression of the seasons is due to the earth's revolution around the sun.

This sun-centered view of the universe was not entirely original to Copernicus. As early as the third century B.C., Aristarchus of Samos had argued that the earth revolves around the sun. In the second half of the fourteenth century, Nicholas Oresme, a follower of the English Franciscan William of Ockham (after whom Occam's razor—the principle that the simplest explanation is best—is named), had proposed the same idea. But such views had been rejected, for certainly they were contrary to common sense. Surely, it was said, this solid earth is not spinning through the heavens; anyone with eyes can see that the sun moves through the sky each day, while the earth remains fixed. If the earth moves, then neither an arrow shot straight up nor a stone dropped from a tower would fall perpendicularly. Would not birds in flight fall behind the spinning earth? More importantly, sun-centered views were contrary to the teaching of the Church. As God's special creation, humans should occupy a privileged position at the center of the universe. After all, the Bible states that God labored for five days to create the earth, but spent only one day on the remainder of the universe, and rested on the seventh. Having made men and women in his image and having lavished such care and time on the earth's creation, surely God would not then place the earth in a peripheral position, spinning giddily around the sun. The earth must be at the very center of the universe.

Such arguments were difficult to counter. When backed by the tradition and authority of the Church, they had the force of dogma. To oppose them was heresy. Anticipating an unfavorable reaction to his theory, Copernicus delayed the publication of *De revolutionibus coelestium orbium* (On the Revolution of the Heavenly Spheres) for thirty-six years. According to tradition, he saw it for the first time in 1543 as he lay on his deathbed. Fearing an unfavorable reaction, his assistant, Andres Osiander, inserted a preface asserting that the rotating and revolving earth was to be considered a hypothesis, a mathematical convenience to simplify the description of planetary motion.

Some called Copernicus the reformer of astronomy, a second Ptolemy, a man who changed forever the conceptions of the universe. But his theory was also unacceptable to many, especially the Church. His system was labeled absurd and antireligious. One cardinal riposted: "The Holy Spirit intended to teach us how to go to heaven, not how the heavens go" (Kesten, 1945, p. 316). Copernicus had demoted humans from a central to a peripheral position in the universe. Were human beings no longer the sacred creation of God? An even more shattering view was proposed later by a Dominican monk, Giordano Bruno (1548–1600), who lectured in Rome, Geneva, London, Oxford, and Paris, defending Copernicus and extending his system. Bruno proposed the existence of not just one sun but innumerable suns, not just one earth but innumerable earths, each revolving around its own sun and potentially inhabited by sentient[3] beings. He described a limitless universe. Such views cost Bruno his life. Among the market stalls of Rome's Campo dei Fiori, a statue marks the spot where Bruno was burned at the stake in 1600.

Galileo Galilei (1564–1642)

Galileo was born in Pisa, Italy the year William Shakespeare was born in England. Galileo advanced Renaissance astronomy and also laid the foundations of the scientific method still used today. But as a student at the University of Pisa, he found the atmosphere stuffy and pretentious. In response to the rule that members of the university must wear their academic gowns at all times both on and off campus, Galileo wrote a satirical poem entitled *The Wearing of the Gown.* He advocated that members of the faculty, rather than wearing their gowns, should go naked at all times. The university authorities were not amused. Galileo left for Padua and then Venice.

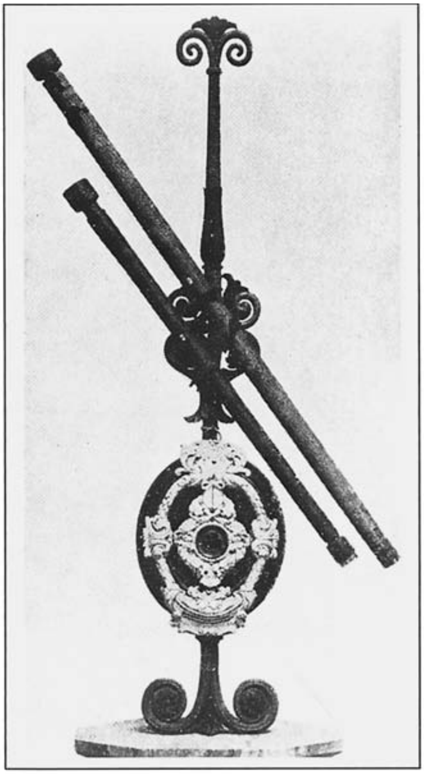
[3] sentient, adj. Having the power of perception by the senses (RHDEL, p. 1300).

A serendipitous[4] observation by Hans Lippershey, a Dutch lens maker, changed the direction of Galileo's career. In 1606, Lippershey noticed—while walking in his workshop between racks of spectacle (glasses) lenses—that when he looked through a convex and concave lens that happened to be aligned, the distant spire of a church appeared nearer. Lippershey mounted two lenses a certain distance apart in a tube so that light would be collected by a lens at the far end of the tube and the image would be magnified by a smaller lens, which served as the eyepiece. He had constructed the first refracting telescope. Galileo was commissioned to investigate Lippershey's claim to have invented a telescope—an instrument that would allow one to see (*scope*) at a distance (*tele*). His shrewd patrons saw that such a device could be used in both war and peace. In war, a telescope could be used to give warning of and to ward off attacks; in peace, a merchant with a telescope stationed on the top of a bell tower (campanile) might see a ship far out in the harbor. Secret signal flags would reveal the ship's cargo of pepper, spices, or cloves. With that foreknowledge, speculators could make a good deal of money on the Rialto, a trading market in the center of Venice. Galileo found Lippershey's claims to be true. Galileo learned how to grind lenses, itself a considerable technical achievement. By 1609, he was able to make lenses that increased the magnification factor of his telescope from 3 to about 30. However, such a marvelous instrument[5] should not be used just to satisfy the merchants and politicians of Venice; it could be used to advance astronomy. So Galileo pointed his telescope toward the stars. He saw for the first time "wondrous sights": four new moons of Jupiter, which Galileo shrewdly named the "Medicean moons" in honor of his patrons, the powerful Medici family; mountains, craters, and valleys on the moon's surface, which he captured in a series of wash paintings; the mysterious milk of Venus, which he saw as uncountable thousands of faint stars; and the two rings of Saturn, which we now know to be the remnants of a shattered moon (Benson, 2002). Galileo also concluded that Copernicus had been correct, that the sun was indeed the center of the universe. The poet John Donne wrote of Galileo's observations:

> And new Philosophy calls all in doubt,
> The Element of fire is quite put out;
> The sun is lost, and th'earth, and no man's wit
> Can well direct him, where to look for it.
> (Byard, 1977, p. 121)

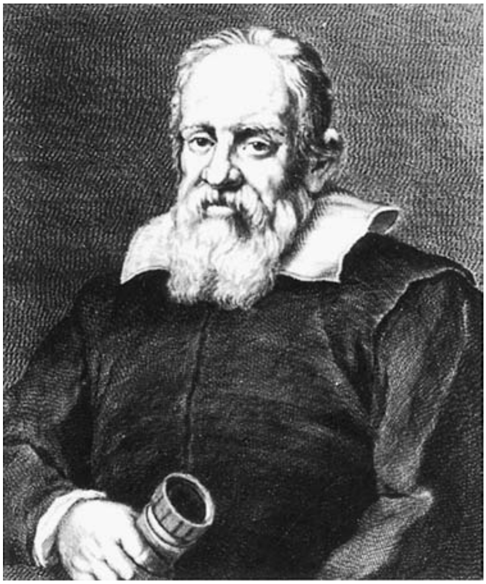
Galileo described his observations and presented his conclusions in *Sidereus nuncius* (Message from the Stars), published in Venice in 1610. The year 1610 was less than one hundred years after Martin Luther's denunciation of the papacy in 1517 and the Reformation that split Western Christendom into the Roman Catholic and Protestant churches. It was no time to challenge the Church's authority. On February 24, 1616, the Congregation of the Index, the

[4] *serendipity,* n. The faculty of making desirable discoveries by accident. Horace Walpole so named a faculty possessed by the heroes of a tale called *The Three Princes of Serendip* (RHDEL, p. 1302).
[5] Two of the telescopes Galileo used are displayed in a museum dedicated to Galileo at the astrophysical observatory in Arcetri near Florence, Italy.



The telescope the Italian astronomer Galileo used in 1609 to observe the solar system.
(Courtesy, Department of Library Services, American Museum of Natural History)

censorship body of the Church, condemned the teaching of Copernicanism. The earth, not the sun, was the center of the universe, they declared; and the powerful Robert Cardinal Bellarmine, who was in charge of the Inquisition, firmly instructed Galileo to stop advocating the new theory (Redondi, 1987). But the questions that Galileo's observations raised could not be ignored. The Church taught that the stars had been placed in the night sky by God as an aid to human navigation. But with his telescope Galileo saw many new stars that could not be seen by the unaided eye. Why had God placed them in the sky? The learned cardinals replied that they had been placed in the sky by God, who knew that the telescope would be invented. But Galileo was not convinced. On August 6, 1623, Maffeo Cardinal Barberini, a friend of Galileo, became Pope Urban VIII. Anticipating his support and that of the powerful Medici family, Galileo felt free to resume his advocacy of Copernicanism. In 1632, Galileo published a *Dialogue on the Two Greatest Systems of the World, the Ptolemaic and the Copernican.* He created a hypothetical debate on the geocentric and heliocentric systems. With clarity and wit, the debaters argued that the sun, not the earth, is the center of the cosmos and that the earth is not at rest but rotates on an axis



Galileo Galilei (1564–1642). Renaissance astronomer, mathematician, and developer of the scientific method.
(National Library of Medicine)

and revolves around the sun. At the debate's end, the participants concluded that Copernicus was correct. Pope Urban supported Galileo, insisting only that the *Dialogue* carry a disclaimer that Copernicanism was a hypothesis. When Galileo placed that disclaimer in the mouth of one of the debaters, Simplicius, a simpleminded fellow of shallow thoughts and limited ability, his fate was sealed.

The *Dialogue* was placed on the Vatican's *Index of Prohibited Books.* Galileo was summoned to Rome, tried by ten cardinals, and on June 22, 1633, found guilty of teaching doctrine judged to "be absurd, false in philosophy, and formally heretical . . . that can in no way be probable, which had been already declared and finally determined contrary to the Divine Scripture" (Galileo's trial sentence, in Fahie, 1903, p. 315). For unknown reasons, three of the ten cardinals did not sign Galileo's sentence. In this confrontation between observation and authority, authority triumphed. It seems likely that Galileo was at least shown the instruments of torture before being made to kneel before the cardinals and sign the following abjuration:[6]

> I abjure, curse, and detest the said errors and heresies, and generally every other error and sect contrary to the said Holy Church; and I swear that I will never more in the future say, or assert anything, verbally or in writing, which may give rise to a similar suspicion of me. (Galileo's abjuration, in Fahie, 1903, p. 320)

[6] *abjure,* v. to renounce, repudiate, or retract, especially with solemnity (RHDEL, p. 3).

Legend has it that even as he signed the abjuration, Galileo muttered "Eppur si muove" (But it does move). Galileo was forbidden to publish, all copies of his books that could be found were burned, and he was confined to his villa in Arcetri, near Florence, for the rest of his life. The poet John Milton was one of only a handful of visitors. In his final years, the man whose observations had enlarged the vision of the Renaissance world a thousandfold became almost totally blind.

In 1979, Pope John Paul II, speaking before a special session of the Vatican's Pontifical Academy of Sciences, acknowledged Galileo's outstanding contribution to science and recognized the bitter conflict his case had caused between church and science. John Paul expressed the hope for "a fruitful concord between . . . church and world" (Pope John Paul II, 1980, p. 11). In November 1992, the Pope went even further and acknowledged that the church had erred in convicting Galileo.

Galileo was also a pioneer experimenter who developed the method of controlling certain factors (variables) while manipulating and measuring others. In his experiments, he studied the relationship between the distance an object had fallen and its speed. Contrary to myth, these observations were not made by dropping objects from the Leaning Tower of Pisa, but by rolling balls down inclined planes. He carefully manipulated such factors as the weight of the ball and the incline of the plane. Galileo formulated the law of free fall: the distance an object has fallen from rest equals the square of the time since it was released. Speed is proportional to the time of the fall. So precise were Galileo's descriptions of his experimental procedures that a contemporary investigator, Stillman Drake, was able to replicate them exactly (Levere & Shea, 1990). One puzzle is how Galileo made such precise time measurements. Drake suggested that Galileo first used musical beats and half beats to time his intervals. Singing "Onward, Christian Soldiers" at a crisp tempo of about two notes per second, Drake recorded time intervals very close to those Galileo reported (Drake, 1975, p. 101). In later experiments, Galileo used an egg timer-like device in which liquids flowed from one chamber to another and then a pendulum timer he invented. The careful control and measurement of variables that Galileo achieved in what he termed his "novelties" provided a model for experimentation in the physical and biological sciences and eventually in psychology.

In his *Dialogue,* Galileo predicted that Italian science and trade would be overtaken by northern rivals unless scientists were guaranteed freedom of inquiry. In the margin of his own copy of the *Dialogue* Galileo wrote:

> In the matter of introducing novelties. And who can doubt that it will lead to the worst disorders when minds created free by God are compelled slavishly to an outside will? When we are told to deny our senses and subject them to the whim of others? When people devoid of whatsoever competence are made judges over experts and are granted authority to treat them as they please? These are the novelties which are apt to bring about the ruin of commonwealths and the subversion of the state. (Galileo in Newman, 1956b, p. 733)

Galileo's passionate plea for untrammeled freedom of inquiry resounds through the centuries. He believed absolutely in the power of reason, for "in questions of science, the authority of a thousand is not worth the humble reasoning of a single individual" (Galileo in Newman, 1956b, p. 734). Conditions in Italy were manifestly inhospitable to the scientific approach to the acquisition of knowledge Galileo advocated. Just as he predicted, the next great scientific advances came about in Germany and England, Protestant countries of northern Europe.

Two Contributions from England

Isaac Newton (1642–1727) was born on Christmas Day the year Galileo died. Circumstances surrounding his birth could hardly have been less promising. England was about to descend into a generation of bloody civil war due to religious divisions. Newton's birthplace, the hamlet of Woolsthorpe in Lincolnshire, was little more than a few small farms and cottages clustered near a manor house. Newton was either premature or conceived before his parents' marriage that April. His father, a prosperous yeoman, died a few months before his son's birth. His mother was from the lower gentry. When Isaac was three, she married Barnabas Smith, an elderly, well-to-do rector (clergyman) from a nearby town. Newton was left with his maternal grandparents. At the age of twelve, Newton enrolled in King's School, boarding with the family of the local apothecary (pharmacist). From him Newton learned to transcribe prescriptions and to experiment with chemicals. He also learned to make and fly kites, design sundials, power a miniature windmill with a resident mouse, and build various machines and contrivances (White, 1997). (When he visited Trinity College, Cambridge in 1955, the American psychologist Ernest Hilgard was shown a still-ticking clock constructed by Newton [Hilgard, 1987, p. 8].) The school's headmaster recognized Newton's brilliance and urged his mother to give up her plans for Isaac to run the family farm. Newton was an inept and sluggish farmer, so his mother agreed that he should attend Cambridge. As a student, scholar, fellow and, by 1669 at the age of 26, Lucasian Professor of Mathematics,[7] Newton became a great Cambridge luminary. His bust in the chapel of Trinity College, Cambridge is inscribed:

> *Qui genus humanum ingenis superavit*

which might translate as, "He who surpassed all men of genius."

Newton was fascinated with light. It was everywhere; so, too, were colors. But where did the colors in white light come from? In 1666, Newton described to the Royal Society how he had "procured me a Triangular glass-Prisme and conducted experiments on the 'phenomena of colors.'" White light passing through the prism was refracted into its component colors: brilliant red, orange, yellow, green, blue, indigo, and violet fell on the wall of Newton's study. When the refracted rays were made to converge by passing through a second prism, the result was whiteness, a phenomenon Newton found even more wonderful than the color spectrum itself. Newton's demonstration that white light can be refracted into its component colors and then individual rays recombined to produce whiteness was a definitive scientific demonstration of the seventeenth

[7] Stephen Hawking—author of *A Brief History of Time,* a book that sold 9 million copies globally; *The Universe in a Nutshell;* and many other books and papers—is the current Lucasian Professor of Mathematics at Cambridge.

century. It showed the value of mathematics as the language of science and the power of inductive, experimental methods in understanding nature. Alexander Pope (1688–1744) wrote in his "Epitaph for Sir Isaac Newton":

Nature and Nature's laws lay hid at night:
God said, Let Newton be, and all was light.

But not all reactions were positive. Goethe wrote that Newton's analysis of light "would cripple nature's heart." In his poem *The Tables Turned,* William Wordsworth admonished Newton:

Up, up my friend and quit your books
Or surely you'll grow double
Up, up my friend and clear your looks
Why this toil and trouble?

The poem ends with this verse:

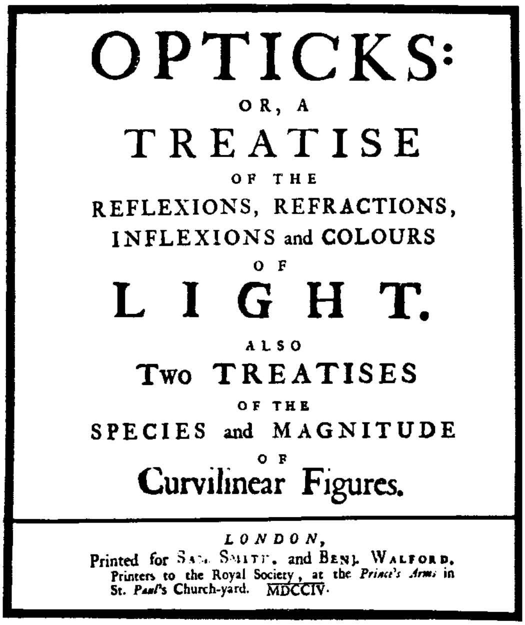
Sweet is the lore which Nature brings;
Our meddling intellect
Mis-shapes the beauteous forms of things:—
We murder to dissect.

In *Lamia,* Keats protested that to "unweave a rainbow" is to "clip an Angel's wings." In a notorious toast, Keats proposed "Confusion to mathematics and Newton."

Clearly, though, Newton's analysis of light was a triumph of physics. A later generation of philosophers, the British empiricists, would try to do for human consciousness what Newton had done for light; that is, to refract consciousness into its elements. This was the model of the mind some members of the first generation of psychologists adopted in the late nineteenth century.

Voltaire said of Newton that he had been more fortunate than any other scientist could ever be, since it could fall to only one man to discover the laws that govern the universe. Newton's great discovery was that the same force that pulls an apple to the ground also holds the moon in its orbit around the earth and the earth in its orbit around the sun. That force is gravity. In his majestic *Principia,* published in 1687 when he was 45 years of age, Newton described a lawful, clockwork universe designed by God the "Great Watchmaker" and understandable through mathematics and the application of the calculus Newton had invented. The Newtonian universe, with its planets all moving in the same direction along elliptical orbits, was lawful and predictable. Such an outcome, according to Newton, could not have occurred by chance. Rather it arose "from the counsel and dominion of an intelligent and powerful being" (Newton in Grabiner, 1988, p. 225).

Given his secure place as one of the greatest figures in the history of Western science, it is surprising to find that Newton had a checkered later career. He moved to London in 1696, served briefly as a Member of Parliament, and then was appointed Warden of the Royal Mint. His duties included pursuing counterfeiters, then a capital offense. Newton, the eccentric mathematician known for scratching diagrams and equations on gravel walks, lecturing to empty halls in the clothes he had slept in, and neglecting to eat, pursued his



OPTICKS:
OR, A
TREATISE
OF THE
REFLEXIONS, REFRACTIONS,
INFLEXIONS and COLOURS
OF
LIGHT.
ALSO
Two TREATISES
OF THE
SPECIES and MAGNITUDE
OF
Curvilinear Figures.

LONDON,
Printed for SAM. SMITH, and BENJ. WALFORD,
Printers to the Royal Society, at the Prince's Arms in
St. Paul's Church-yard. MDCCIV.

The title page of the 1704 edition of Sir Isaac Newton's "Opticks."
(From the cover of Science, *January 16, 1976, vol. 191, no. 4223)*

duty as Warden with great enthusiasm and efficiency. He is said to have sent more than one poor wretch to the gallows (Westfall, 1980).

Towards the end of his life, Newton devoted himself to alchemy, assembling a collection of 138 books on that topic. He sought the *alkahest* or *panacea* that would transmute base metals such as lead into the noble metal of gold. Newton's periodic bizarre behavior has been attributed to his exposure to the mercury he used in his alchemy (Klawans, 1990). He lost a fortune in speculative investments and sadly admitted: "I can calculate the motions of heavenly bodies, but not the madness of people" (Malkiel, 1999, p. 45). Knighted Sir Isaac Newton by Queen Anne, he died in 1727 and was buried in Westminster Abbey.

In the eighteenth century, the British astronomer Sir Edmund Halley reasoned that three spectacular comets recorded in 1531, 1607, and 1682 were the same one. Using Newton's law of universal gravitation to plot its orbit through space, Halley predicted that the comet would return seventy-six years later, in 1758, and every seventy-six years thereafter. Halley died in 1742 and so did not see the comet's reappearance on Christmas Day of 1758, just as he had predicted. Halley's demonstration of the predictability of a physical phenomenon showed the power of the human mind to understand the universe through the application of scientific laws. It was a triumph of what came to be known as the Age of Enlightenment. To quote a seventeenth-century anonymous doggerel verse:

Of all the comets in the sky
There's none like Comet Halley
We see it with the naked eye
And periodically.

Halley's Comet was last seen in 1910 and 1986.

In 1543, Copernicus had caused a scientific revolution with *De revolutionibus*. That same year a second revolutionary work was published: *De humani corporis fabrica librin septum* (The Fabric of the Human Body). The author was Andreas Vesalius (1514–1564), the leading anatomist of the time. Vesalius was considered the successor to Hippocrates and Galen, but more importantly was an anatomist who did not rely upon the classical texts, but on anatomical observations of the body. For Vesalius, the body was a book the anatomist could read using the methods of dissection. At the University of Padua he dissected hundreds of bodies, presenting his results and demonstrations in a specially constructed lecture theater.

After receiving his degree from Caius College, Cambridge in 1597, William Harvey (1578–1657) traveled to the University of Padua to study medicine and anatomy with the successors of Vesalius. He returned to England in 1602, established a successful medical practice, and initiated an active research program on the movement of the heart and the motion of blood. Harvey's methods were observational and experimental. He found blood in animals as varied as frogs, chickens, pigeons, goats, sheep, oxen, and mice, and even in such seemingly less promising specimens as eels, crabs, slugs, snakes, snails, wasps, and flies. The pervasiveness of blood in the biological world fascinated Harvey just as light had fascinated Newton. Before that time, the heart had been thought to "concoct" blood, which carried nutrients through the veins and arteries in a unidirectional flow outward from the heart. Harvey weighed the amount of blood in a human corpse and in a sheep. The amounts were comparable, about four pounds. Next he bled a sheep and measured the amount of blood, about two ounces, that was ejected with each beat of the heart. By noting the number of beats per minute, 72, Harvey calculated that in sixty minutes

$$2 \times 72 \times 60 = 8{,}640 \text{ ounces}$$

or

$$8{,}640/16 = 540 \text{ pounds}$$

of blood would be expelled by the heart. Similar calculations for humans, dogs, and cattle showed that the amount of blood the heart moved in an hour always exceeded the amount of blood in the body (Magner, 1992, p. 201). Harvey's conclusion was that the heart does not make blood, but rather pumps it round the body. The heart ejects blood with each beat; the blood flows round the body and returns to the heart to be ejected again. Harvey delayed in publishing his findings. He feared that his conclusions concerning the action of the heart and the movement of blood were so novel and revolutionary that he expected to make an enemy of all humankind. Finally published in 1628, Harvey's *Anatomical Treatise on the Heart and Blood in Animals,* usually referred to as *De motu cordis* (The Movement of Blood), is one of the greatest scientific works of the Renaissance.

Harvey had demonstrated that a biological system could be studied with the same experimental rigor with which physicists studied physical systems. Consequently, the success of his demonstration pointed the way to experimental biology. Harvey also speculated that "blood is the cause not only of life in general, but also of longer life, of sleep and of waking, of genius, aptitude and strength" (Harvey, 1628, in Miller, 1982, p. 228). In the twentieth century, blood-borne circulating hormones were shown to be important factors in temperament, cognition, emotion, and sleep. Finally, Harvey's research began the demystification of the heart that was to lead in the twentieth century to public acceptance of heart transplants.

Harvey investigated many other matters, including the behavior of insects. That work was lost as most of his manuscripts were destroyed during the English Civil War when his rooms were looted. Such is his importance, however, that scholars interested in his life and work have scrutinized every known fragment of Harveiana, studying the origins of his ideas (Keynes, 1989; Cook, 1992, p. 262).

RENAISSANCE PHILOSOPHY

René Descartes (1596–1650)

In addition to advances in science, developments in Renaissance philosophy provided an important foundation for psychology. As the Renaissance philosophers pursued knowledge of things and their causes, they developed insights and theories that greatly influenced later psychologists. René Descartes was a leading French mathematician and philosopher during the years preceding and immediately following Galileo's trial. He was born in 1596 at La Haye near Tours, the son of a councilor at the provincial parliament of Brittany. His family inheritance allowed him to pursue a life of study and travel unencumbered by the need to earn a living. From 1606 to 1614, Descartes attended a Jesuit school near Anjou. The Jesuits, the intellectual foot soldiers of the Catholic Church, were known for their excellent schools. From them he received a rigorous classical education with a strong emphasis on the humanities, mathematics, religion, and philosophy. By claiming frail health, Descartes was able to convince the school's rector that he should be excused from early morning religious exercises and allowed to stay in bed. All his life, Descartes believed that he did his best thinking in the morning, in bed. Bertrand Russell said that Descartes's mind worked best when he was warm (Russell, 1945, p. 558), and Descartes's biographer reports that staying in bed became for him "a habit which he maintained all his life and which he regarded as above all conducive to intellectual profit and comfort" (Mahaffy, 1880, p. 12). In 1616, Descartes took a Bachelor's degree and license in law at the University of Poitiers.

In 1618, the previously contemplative and reclusive Descartes volunteered for service in a mercenary army in Holland. On November 10, 1619, he was alone in a stove-heated hut where, as he later recalled, he was able "to converse with himself." Descartes fell asleep, and in a dream the "Spirit of Truth" entered his mind. This dream, with its vision of a new system of science and mathematics, changed his life. The next day he renounced what he saw as his past idleness and resolved to devote himself to the search for truth and the unification of science through the power of reason. At the age of 23 Descartes resolved to write a rationalist manifesto. His first great success was to combine the methods of algebra and geometry into analytical geometry. He developed methods that allow geometric propositions to be translated into algebraic terms, geometric curves to be described by equations, and the position of a point to be defined by coordinates on two perpendicular lines. The latter insight came to his mind as Descartes considered how to describe mathematically the exact position of a fly in his room. At any moment in time, the fly's distance from the ceiling (or floor) and from two adjacent walls would define its position. Those distances defined the fly's coordinates. As the fly moved, its path could be described as a series of points, which in turn could be combined to form a curve. Descartes carried the ideas of analytic geometry with him through a number of battles and misadventures before publishing them eighteen years later in *La Géométrie* (Geometry). The work was an immediate success and secured Descartes's reputation as a mathematician. The book, he said, was written in a "contemptuous vein" and was intended to show what Descartes knew, more than to instruct the novice. He concluded his exposition with this ironic comment: "I hope that posterity will judge me kindly, not only as to the things I have explained, but also as to those which I have intentionally omitted so as to leave to others the pleasure of discovery" (Descartes, in Newman, 1956a, p. 237). On both counts his hopes have been fulfilled.

Descartes left France for Holland in 1629 to seek a life of scholarly solitude. So great was his need for peace and quiet that during the twenty years he was in Holland, Descartes lived in twenty-four different houses in thirteen different towns, allowing only a small number of trusted friends to know his whereabouts. Despite these precautions, his fame came to the attention of Queen Christina of Sweden. She wanted to know how to live happily and still not annoy God. Who was better qualified to answer her question than Europe's foremost thinker? In 1649, Queen Christina summoned Descartes to Stockholm to adorn her court and act as her private tutor in philosophy and mathematics. Upon receiving her summons, Descartes is said to have had a presentiment of death, but he had no option but to comply, especially when Christina sent a warship to transport him to Sweden. The young queen proved to be an inept student and, even worse for a man of Descartes's habits and temperament, insisted on having her lessons at 5 A.M. Descartes withstood the queen and the Swedish winter for only four months before dying of pneumonia on February 11, 1650. In a grisly irony, the only available coffin was undersized, and so Descartes's head was severed from his body before burial, and the two were never reunited (Boakes, 1984).

In addition to his contributions to mathematics, Descartes was also a founder of modern Western philosophy. He hoped to build a radical new system of philosophy from the ground up—a logical, scientific system of thought. He presented it in *Discourse on the Method of Rightly Conducting the Reason, and Seeking Truth in the Sciences,*[8] published in 1637. The *Discourse* was his first book. Descartes wrote it in French rather than Latin, as he hoped to reach a broad audience. Despite its formidable title, the *Discourse* is a readable and informal work. Above all else, Descartes sought truth: knowledge that could not be

[8]Available on the web.

doubted, knowledge that was certain. He adopted a rigorously scientific attitude, resolving to follow rules of logic he judged sufficient to attain truth:

> The first was never to accept anything as true that I did not evidently know to be such; that is to say carefully to avoid precipitation and prejudice, and to include in my judgments nothing more than what would present itself to my mind so clearly and distinctly that I were to have no occasion to put it in doubt. (Descartes, 1637, in Heffernan, 1994, p. 35)

The Jesuits who had educated Descartes made the proud claim "Give us the boy and we've got the man." Indeed, Descartes considered himself devout and always insisted that his many homes be within walking distance of a Catholic church. However, at times he doubted the existence of God and believed that even the most passionate theist must occasionally have similar doubts. From an empirical standpoint, he reasoned, we cannot be absolutely certain of God's existence. Such views were heretical to Catholic theologians. Descartes's works, like Galileo's, were placed on the *Index of Prohibited Books,* and booksellers were not allowed to print them. The theologians of Utrecht in Holland, at that time under the control of Catholic Spain, even brought Descartes before a court to answer charges that he was "an atheist, vagabond, and profligate" (Newman, 1956a, p. 236). Fortunately, the charges were dismissed.

Along with his doubts about the existence of God, Descartes also concluded that most of what he knew he had acquired in haphazard, uncritical, and unreliable ways. He found himself in an acute existential dilemma as he came to doubt and question such apparent givens as the very existence of the world and even of ourselves. He concluded that at any instant the only thing he could be certain of was that he was thinking about something. Thus, for Descartes, the final proof of his existence was his act of thinking: *Cogito ergo sum*[9] (I think, therefore I am). Descartes wrote:

> I noticed that while I was trying thus to think everything false, it was necessary that I, who was thinking this, was something. And observing this truth 'I am thinking, therefore I exist' was so firm and sure that all the most extravagant suppositions of the skeptics were incapable of shaking it, I decided that I could accept it without scruple as the first principle of the philosophy I was seeking. (Descartes, 1637, in Cottingham, Stoothoff, & Murdoch, Volume 1, 1985, p. 127)

If thinking is the ultimate proof of our existence, it is important to know how and where we think. For Descartes, we think with our *res cogitans* (thinking thing), the mind. But the mind is different from the body. It is unextended, free, and lacking in substance. In contrast, the body is extended, limited, and has substance. There is, Descartes claimed, a dualism of mind and body. Not only do the mind and body have these different characteristics, but in their functions they follow different laws. The body's actions are governed by mechanical principles and laws, for the body is nothing more than a highly complex machine. Our bodies are largely self-regulating physical systems performing many functions without the involvement of our minds. We do not have to "will" ourselves to digest lunch, nor do we have to think before withdrawing a

[9] In the witty and irreverent *Devil's Dictionary,* this famous three-word dictum is expanded to: "Cogito cogito, ergo cogito sum—I think that I think, therefore I think that I am" (Bierce, 1958, p. 21).

hand from a flame. Likewise, we do not have to think about each breath or each beat of the heart. The body takes care of these functions automatically.

Descartes's conception of the body as mechanical was influenced by his observations of clockwork statues that bowed to passersby, clocks with cuckoos that would call the hour, fountains, and other "amusements" that were popular at the time in the homes and gardens of the aristocracy. A person strolling through such a garden might step on a hidden trigger that would cause a mechanical bear to spring from a concealed position in a hedge, a fountain to start spraying water, a gargoyle to nod its head, or musical instruments to play. A statue of the goddess Diana bathing would modestly retreat, defended by Neptune shaking his trident. In Descartes's time, such diversions were considered highly entertaining, but Descartes was more impressed with them as models of the human body. Obviously, the bear does not think before leaping out, and Diana and Neptune are inanimate stone. They behave in a simple, mechanical way. In *Traité de L'homme* (Treatise on Man, 1637), Descartes included an engraving of such figures and their driving mechanisms from the royal gardens of Saint Germain-en-Laye.

How does the body's machine work? Descartes believed that hollow tubes or minute threads in the body contain subtle fluids, sometimes called animal spirits, distilled from the blood. These animal spirits are heated and pressurized by the heart and flow out from the sense organs, giving rise to sensation, to the muscles, giving rise to movement. They do so in a form of reflex arc. In the brain, the opening and closing of certain pores allow or block the passage of animal spirits. Descartes's model is a hydraulic pathway conception of the nervous system. In modern terms, the pores play the part of synapses, and the animal spirits that of nerve impulses.

What is the difference between our bodies and other machines? Descartes's answer shows the influence of Galen. The difference, he said, is one of complexity. The human body, having been designed by God, is infinitely more complex than any machine of human invention:

> The body is a machine that, having been made by the hand of God, is incomparably better ordered, and has in itself movements more wonderful, than any of those which can be invented by man. (Descartes, 1637, in Heffernan [1994], p. 79)

What is the difference between the bodies of animals and the bodies of humans? Whereas the bodies of animals are governed solely by mechanical principles, Descartes felt that the human mind can control the opening or closing of certain pores as well as their orientation. Thus, through an exercise of the mind, humans can control certain reflex actions of the human body. Lawrence of Arabia was able to hold his finger in a candle flame. A one-armed trapeze artist can refrain from scratching her nose while performing.

Given that our minds control our bodies, where does the interaction actually take place? What is its locus? Descartes chose as the site a pea-sized structure in the brain, the *conarium,* or pineal gland. In this brain structure, he said, the mind exercises its functions "more particularly than in other parts" (The Passions of the Soul, Article XXXI). He selected the pineal gland because he believed that it is not, unlike most other cerebral structures, duplicated in both sides of the brain. To Descartes, a unitary structure seemed a logical site for the interaction between mind and body. His choice was simply a hunch, for he had no idea how the interaction might occur or what the functions of the pineal actually are. Even today, some mystery surrounds the pineal. We know that it secretes serotonin precursors, which control activity cycles, and that it becomes increasingly radiopaque with age. Consequently, it is often used as a landmark in brain X rays.

Descartes believed there are two major classes of ideas in the mind: innate ideas,[10] which are inborn and do not depend on experience, and derived ideas, which arise from experience. Examples of ideas Descartes considered innate include the ideas of self and God; conceptions of time, space, and motion; and geometric axioms. Other ideas come from individual experience and are based on memories of past events. Descartes believed that a particular experience produces alterations of the nervous system and that these alterations have effects on the mind when it acts to recall experiences. His analogy for the way in which memories form is characteristically original. Descartes imagined that the passage of animal spirits through certain pores in the brain forces open those pores and produces a lasting representation of their path. He compared the pores to the holes made in a linen cloth when punched through by a set of needles. When the needles are withdrawn, the holes stay partially or completely open; the "memory" of the needles lingers. When the mind seeks to recall something, Descartes proposed, this act of volition causes the pineal gland to lean first to one side and then to the other, causing spirits to flow to different regions of the brain. Memory traces in those brain regions are stimulated, and specific memories are recalled.

One final characteristic of humans, according to Descartes, is that we have passions. These passions arise from the body, are passively experienced by the mind, and lead without further volition to bodily actions. Descartes defined the six primary passions as wonder, love, hate, desire, joy, and sadness. All other human passions are mixtures of the primary six.

According to Descartes, animals do not possess minds so they are incapable of language or self-awareness (Radner & Radner, 1989). Thus, he made a firm psychological demarkation between humans, who have both language and self-awareness, and all other animals that do not. One consequence of the Cartesian position was that animal dissections were permissible. Descartes himself performed many such studies. He is usually given credit for the first description of the retinal image, published in 1637. He extracted the eye of an ox, cut a window in the back of it, and placed a piece of paper in the opening. Holding the eye up to the light, he saw on the paper a tiny inverted image of his room. This was the first demonstration of the inversion function of the eye. Other dissections were done on live animals without anesthetics, which were not developed until the nineteenth century. But Descartes performed his dissections without moral or ethical qualms, convinced that animals were without

[10] The *Devil's Dictionary* comments: "The doctrine of innate ideas is one of the most admirable faiths of philosophy, being itself an innate idea, and therefore inaccessible to disproof" (Bierce, 1958, p. 67).

feelings. Their cries and yelps were nothing more than the hydraulic hisses and vibrations of machines (Jaynes, 1973, p. 170).

Descartes's influence on philosophy is widely acknowledged, but he was also important in the historical development of psychology.[11] His clear concept of a dualism of mind and body provided a paradigm that has adherents even today. The Cartesian position that different principles and laws govern the actions of the body and those of the mind has obvious implications for psychology, the science of the mind. Finally, his distinction between innate and derived ideas anticipated the nature versus nurture debate that has been a prominent feature of many psychological systems.

Julien de La Mettrie (1709–1751)

In 1748, almost one hundred years after Descartes died, Julien de La Mettrie published a work entitled *L'homme Machine* (Man the Machine) in which he argued that people are solely machines and that their actions can be explained exclusively through mechanistic principles. According to La Mettrie, we differ from other animals only in the complexity of our machinery—not, as Descartes had asserted, because we have minds, or, as the theologians believed, because we have souls. La Mettrie attacked the conception of the person as a rational animal, arguing that we, like other animals, are motivated solely by the need to seek pleasure and avoid pain—by hedonistic[12] drives. He believed that degrees of thought are present in animals as well as humans, and he described cognition as a continuum, with greater and lesser amounts present in different organisms. According to La Mettrie's position, it is just as incorrect to say that apes and other animals totally lack rationality as it is to say that humans are perfectly rational.

More specifically, La Mettrie challenged the assumption that only humans are capable of acquiring and using symbolic language. He predicted that if an ape were taught sign language with as much care and diligence as is commonly used in teaching a deaf child, the ape would show clear evidence of an ability to use language. After this training, such an animal, La Mettrie predicted, "would no longer be a wild man, nor a defective man, but he would be a perfect man, a little gentleman, with as much matter or muscle as we have, for thinking and profiting by his education" (La Mettrie, cited by Limber, 1982, p. 432). For more than two centuries, both La Mettrie's views and his suggestions were rejected. Language came to be regarded as a uniquely human attribute, an ability that not even our closest primate relatives are capable of developing. However, recent research by comparative psychologists has demonstrated that a number of chimpanzees can acquire symbolic language (Savage-Rumbaugh, Rumbaugh, & Boysen, 1978; Parker & Gibson, 1990).

[11] Scholarly interest in Descartes remains high. The year 1995 saw publication of two biographies: *Descartes: His Life and Thought* by Genevieve Rodis-Lewis and *Descartes: An Intellectual Biography* by Stephen Gaukrogers.

[12] *hedonism*, n. The doctrine that pleasure or happiness is the highest good (RHDEL, p. 657).

POST-RENAISSANCE PHILOSOPHY: EMPIRICISM, ASSOCIATIONISM, AND NATIVISM

The Early Empiricists

During the years after the Renaissance, several advances were made in philosophy that ultimately laid the conceptual foundations for psychology. The early *empiricists*—Thomas Hobbes, John Locke, and George Berkeley—emphasized the effects of experience on a passive mind. The later *associationists*—David Hume, David Hartley, and James and John Stuart Mill—considered the role the active mind plays in forming associations, thus setting the stage for the psychological study of learning and memory. However, philosophers from Germany—Gottfried Wilhelm von Leibniz and Immanuel Kant—perpetuated *nativism*, the view that the contents of the mind are not solely the product of experience, but are influenced by its inborn structure.

Thomas Hobbes (1588–1679)

Thomas Hobbes knew of both Galileo and Descartes. He not only anticipated *British empiricism* and was a major influence on seventeenth-century philosophical and political thought, but he also studied the contents of the mind and made statements about human nature still quoted today. Hobbes's view of human nature formed the basis of his social and political theories concerning the origins and organization of groups. Why did humans first assemble in groups? Having done so, how did they stay together? Since Hobbes felt that we are basically aggressive animals, he believed that small groups of people originally banded together to protect themselves from the aggression of others. However, the social proximity of individual members increased the chances of self-destructive internal aggression within the group. According to Hobbes, the only way the group's integrity could be sustained was through a strong, centralized authority, and without such authority there would be

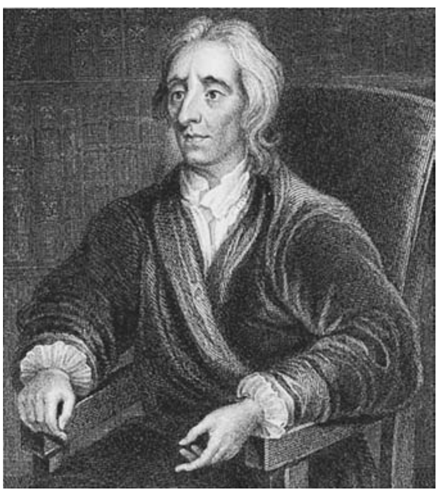
> no arts, no letters, no society and which is worst of all, continual fear and danger of violent death, and the life of man solitary, poor, nasty, brutish, and short. (Hobbes, 1650, p. 85)

In the *Leviathan* (1650), Hobbes argued that the centralized power his analysis of human behavior had shown was essential should be held by a hereditary monarch. Kings and queens claimed to have been chosen by God and to be subject only to God. As King Louis XIV of France proclaimed, "Homage is due to kings; they do as they please." Hobbes considered the monarchy essential to any system of government, not because of any divine right of kings, but because the designation of successive leaders would be undisputed, thus precluding the possibility of conflict. Hobbes translated these beliefs into political action, supporting King Charles I in the civil war of 1642 to 1646 against Oliver Cromwell's revolutionaries. The monarchists were defeated in 1646; Charles I was found guilty of treason and was executed in January 1649. After Cromwell established a republican government, Hobbes fled to political exile in France and became tutor to the future Charles II. After the restoration of the monarchy and the coronation of his former student in 1660, Hobbes returned to England and obtained a position in the diplomatic service.

Hobbes's view of human nature is reflected in the thinking of contemporary sociobiologists. David Barash (1977) pointed out that it is difficult for a naked, unarmed human being to kill another human being. We, unlike some other animals, lack the lethal equipment necessary for such killing. Barash argued that, lacking this equipment, we also lack the biological inhibitions that other species have against intraspecific killing. Today, with the availability of weapons and armaments that allow mass killing at a distance, we find ourselves in a deadly evolutionary bind.

John Locke (1632–1704)

John Locke was the first major *British empiricist.* He was born in the country village of Wrington on August 29, 1632. His father, a country attorney and small landowner, showed a great deal of tenderness and affection for his two sons but made certain they learned to exercise the Puritan virtues of sobriety, discipline, and endeavor. Locke was taught to love simplicity and hate excessive ornament and display. In 1647, Locke entered Westminster School adjoining Westminster Abbey in London, where he received a rigorous classical education with emphasis on Greek and Latin. In addition, Locke and his schoolmates must have been aware of the momentous political events occurring, sometimes quite literally, on the other side of their schoolyard wall. Charles I was tried in Westminster Hall, and Locke might have seen him executed. We do know that one of his contemporaries, Samuel Pepys, attended the execution, for he recorded the event in his diary. Such political events must have affected a boy of Locke's intelligence and sensitivity, but despite these distractions he was an excellent student. He was elected to a junior studentship at Christ Church,



John Locke.
(Culver Pictures)

Oxford, in 1652. For the next thirty years, Locke made Oxford his home. As a student he was especially attracted to research in medicine. Though he qualified as a physician, he did not become a professional doctor in that his occasional practice was never performed for monetary gain.

Locke found the philosophy taught at Oxford sterile and dull. While acknowledging that Descartes had been a liberating influence on his intellectual development, the Puritan Locke regarded the Catholic Descartes with suspicion. In particular, the Cartesian doctrine of innate ideas and the conception of animals as automatons were unacceptable to Locke. He also rejected pure speculation as a method of inquiry. Instead, Locke, no doubt influenced by his election as a fellow of the Royal Society, advocated the experimental, observational methods of scientists such as Harvey and Newton. Locke had read Newton's account of his triangular glass-prism demonstration. The elegance and precision of this demonstration served as a model for Locke's work. Even today, psychology models its standards of scientific rigor on Newtonian physics.

In 1667, Locke began his association with Lord Ashley, later the Earl of Shaftesbury, an English political figure of some importance. Locke served as Shaftesbury's adviser, secretary, and family physician and as tutor to his son. Later Shaftesbury appointed Locke his secretary of presentations, a position that placed him at the center of political events. When Shaftesbury's political influence declined, he was imprisoned in the Tower of London. Fortunate to escape, Shaftesbury found exile in Holland. Because of Locke's close association with him, Locke, too, feared political persecution, and in 1683 he fled to Holland. After the William of Orange's overthrow of King James II in 1688, Locke returned to England at the age of 56.

Given his experience, Locke understandably had a great interest in politics and government. One year after his return to England, he published his most important political work, *Two Treatises on Government* (1689/1960). Locke saw government as based on a social contract between the governors and the governed. The state has an obligation to its citizens to protect and preserve certain inalienable rights: personal liberty, equality before the law, and religious equality—although Locke was not sure that equality should be extended to Catholics. To prevent the loss of these rights, Locke believed that the state's power must be limited through a system of checks and balances, the most important being division of government into executive, legislative, and judicial arms. If a government persistently abused its powers, Locke believed that it had broken its contract and debased its trust and so could be overthrown. No European nation translated Locke's enlightened ideas into its governing principles, but his ideas did have an acknowledged influence on the framers of the American Constitution. When Washington, Hamilton, Madison, and Franklin met at the Constitutional Convention in Philadelphia in the summer of 1787, Locke's *Treatises* served as their guide.

Locke's influence persists today. Chinese students in the summer of 1989 launched a bold movement for a democratic government in the Republic of China. In Tiananmen Square in Peking, courageous students faced tanks and troops sent to disperse them and suppress their movement for democracy (Zhao, 2001). When they were interviewed by Western reporters, some of the students quoted John Locke on democracy. During his eighteen years of imprisonment on Robben Island, Nelson Mandela read Locke and included the *Treatise* in the curriculum of the "prisoners' university" he organized (Sampson, 1999). Locke's clear statement of the dignity and worth of the individual and his advocacy of respect for fundamental human rights are reflected in modern codes of professional ethics, including the *Ethical Principles of Psychologists.* The first sentences of the Preamble mandate that psychologists ". . . respect the dignity and worth of the individual and strive for the preservation and protection of fundamental human rights" (APA, 1981, p. 633).

Locke's Philosophy of Education

In contrast to the Hobbesian belief that human beings are aggressive animals, Locke held a much more optimistic and liberal view of humanity. He believed that the original state of human nature was good and that all people are born equal in their potential, making education critical. Locke held that access to a good education should be available to all children. His views on education were published in 1693 as *Some Thoughts Concerning Education.*[13] During his exile in Holland, Locke had corresponded with Edward Clarke, an English gentleman who had written to him for advice on bringing up his 8-year-old son. Locke's letters formed the first draft of his book. According to Locke, children become what they are because of their experiences. When they are young, children are "travelers newly arrived in a strange country of which they know nothing" (Locke, 1693/1964, p. 173). At birth, the cabinets of their minds are empty. They are filled through experience.

As an *empiricist,* Locke denied the existence of innate tendencies, dispositions, or fears in children. Why, then, are so many children afraid of the dark? According to Locke: "If children were left alone, they would be no more afraid in the dark than in broad sunshine; they would in turn as much welcome the one for sleep as the other to play in" (Locke, 1693/1964, p. 49). But often this is not the case. If, for example, a foolish nursemaid tells a child that witches, ghosts, and goblins are abroad in the night looking for bad children, the child will probably fear darkness. Similarly, Locke said that children are accustomed to receive their "food and kind usage" from only one or two people. If they were to be exposed to more than a few people, they would go into the arms of a stranger as readily as into the arms of a parent. According to Locke, the only things we innately fear are pain and loss of pleasure. Through experience, we learn to avoid objects associated with either of these consequences:

> The pleasant brightness and lustre of flame and fire so delights children, that at first they always desire to be handling of it. But when constant Experience has convinced them by the exquisite Pain it has put them to, how cruel and unmerciful it is, they are afraid to touch it and carefully avoid it. (Locke, 1693/1964, p. 151)

Why do so many children dislike school and avoid reading books? Because, Locke said, school and books are associated with canings and beatings—practices

[13] Grant and Tarcov in 1996 published an edition of Locke's *Thoughts,* a work they described as "almost eerily modern" (Grant & Tarcov, 1996, p. xi).

routine in some British classrooms until the middle of the twentieth century. Thus are fears acquired.

Locke also gave explicit instructions as to how "vain terrors may be removed." He used the example of a child afraid of frogs and instructed the parents to treat this fear as follows:

> Your child shrieks, and runs away at the sight of a frog; let another catch it and lay it down a good distance from him; at first accustom him to look upon it, and see it leap without emotion; then to touch it lightly when it is held fast in another's hand; and so on till he can come to handle it as confidently as a butterfly, or a sparrow. By the same way any other vain terror may be removed if care be taken, that you go not too fast, and push not the child on to a new degree of assurance, till he be thoroughly confirm'd in the former. And thus the young soldier is to be trained on to the warfare of life. (Locke, 1693/1964, p. 151)

Locke's view on the acquisition and treatment of fears is remarkably similar to that of John Watson (Chapter 13), and the procedure Locke advocated is almost identical to the one Watson and his colleague Mary Cover Jones used in overcoming a young boy's fear of animals (Watson, 1928a). Joseph Wolpe in *Psychotherapy by Reciprocal Inhibition* outlined a similar desensitization procedure for the treatment of phobias. In an obituary for Wolpe, Rachman (2000) wrote of this procedure:

> Over the years, it has been shaped into one of the most effective and practical psychological treatment techniques and has also been investigated thoroughly for the larger purpose of understanding the nature of fear and anxiety. (Rachman, 2000, p. 432)

It is also a procedure dating back to Locke.

Locke's *Essay Concerning Human Understanding*

Throughout the years of political turmoil, Locke continued to work on his *Essay Concerning Human Understanding.* This work, which marks the formal beginning of British empiricism, has proved to be of great importance in the history of psychology. The story of how it came to be written is instructive. Throughout his years of political involvement, Locke attended seminars in which the participants debated matters of philosophy, science, and politics. Often these sessions ended with the discussants holding conflicting opinions that seemed impossible to resolve. Locke realized that before an attempt was made to resolve these differences, the characteristics of human knowledge and understanding should be uncovered and criteria established to separate certain and uncertain knowledge. This examination proved more difficult than expected. The enormous scope of the task, coupled with disruptions caused by Locke's political involvement, delayed a conclusion until 1690, when, at the age of 57, he published the first edition of his *Essay.*

Locke's work was published just three years after Newton's *Principia* (1687). Newton had described a majestic clockwork universe that follows a single set of rules. Locke's aim was to find a similar set of rules for the human mind. He aimed to "refract" consciousness into its basic elements, just as Newton had refracted light. Once he had delineated the basic elements of consciousness, Locke hoped to account for their interactions and combinations. Locke's system, like Newton's, is atomistic and reductionistic. For him, the basic elements of the mind are ideas, all of which come from a single source—experience. Locke rejected Descartes's "received doctrine" of innate ideas. In a frequently quoted passage, he stated:

> Let us suppose the Mind to be, as we say, white Paper, void of all Characters, without any Ideas; How comes it to be furnished? Whence comes it by that vast store, which the busy and boundless Fancy of Man has painted on it, with an almost endless variety? Whence has it all the materials of Reason and Knowledge? To this I answer, in one word, From Experience. In that, all our Knowledge is founded; and from that it ultimately derives itself. (Locke, 1690/1975, p. 104)

The analogy of the characterless white paper was not original with Locke. As mentioned in Chapter 1, Aristotle had conceptualized the mind at birth as a blank tablet and had emphasized the role of experience. Nevertheless, Locke's statement is a classic exposition of the empiricist position.

Within our experience there are, according to Locke, two sources of ideas: sensations, from contact with external "sensible" objects; and reflections, or internal operations of the mind. These two are "Fountains of Knowledge, from whence all the Ideas we have or can naturally have, do spring" (Locke, 1690/1975, p. 104). These two sources of knowledge give us information about the external world (sensations) and knowledge of the operations of our own minds. In the presence of a flower, we see its color, smell its fragrance, and feel its touch. These sensations provide us with ideas of the flower. But we can also reflect on the flower in our minds. We can think about it when it is not physically present, and thus we have ideas that are independent of sensations. For Locke, sensation and reflection are the mind's *only* source of ideas. Every idea in the mind was once either a sensation or a reflection. Locke realized that our sensations, as the ancient Greeks asserted, are not always reliable. He cited the example of a person suffering from yellow jaundice to whom the world appears yellow; that person has false ideas based on diseased sensations. Similarly, looking at the world through colored glasses will produce false impressions. To prove his point, Locke described the following demonstration. Take three bowls of water, one cold, one lukewarm, and one hot. Arrange them in a row on a table. Place one hand in the cold water and one in hot. One hand, of course, feels cold, and one feels hot; your ideas of the temperatures of the two bowls of water are correct. After they have been in the water for about thirty seconds, take both hands out and place them together in a bowl of lukewarm water. The sensations are discomfiting and confusing. To one hand, the water feels cold, and to the other warm, yet they are in the same bowl of water. Conflicting sensations give false (illusionary) ideas of the water's temperature.[14]

[14] Arnold, Winer, and Wickens (1982) reported that both children and adults experience the Locke water illusion, but they interpret it differently. Children believe there is an actual difference in water temperature, whereas adults generally recognize that the perceived temperature difference is an illusion. In an ingenious test, they asked children and adults what would happen if the pan containing the water was rotated 180 degrees and their hands reinserted. Children answered that the opposite hand would feel either warmer or colder; adults maintained that altering the pan's orientation would have no effect (Arnold, Winer, & Wickens, 1986, p. 257).

According to Locke, ideas are either simple or complex. The same object may evoke a number of different simple ideas—we see at once both motion and color, or the hand feels both softness and warmth—and these simple ideas are associated to form a complex idea. Ideas come to be associated as a result of experience. The mind makes complex ideas out of simple ideas in a number of different ways:

1. Combining a number of simple ideas into one complex idea
2. Bringing two simple ideas together and seeing the relation between them
3. Separating simple ideas from other ideas that accompany them—the process of *abstraction*

Locke's model of the human mind was that of a chemical compound, and it seems likely that he was influenced by the Oxford chemist Robert Boyle's demonstration thirty years earlier of chemical elements and chemical compounds.

But what would be the contents of the mind if our experience had been restricted in some way, and such processes had never occurred? In one of the most fascinating passages of the *Essay,* Locke presented the speculations of his friend, the "Learned and Worthy Mr. Molyneux of Dublin," concerning the reactions of a formerly blind man, suddenly made to see, when he first encountered familiar objects visually. Wiliam Molyneux (1656–1698) had written to Locke:

> Suppose a Man born blind, and now adult, and taught by his touch to distinguish between a Cube and a Sphere of the same metal, and nighly of the same bigness, so as to tell, when he felt one and t'other, which is the Cube, which is the Sphere. Suppose then the Cube and Sphere placed on a Table, and the Blind Man to be made to see. Quaere [Query], whether by his sight, before he touched them, he could now distinguish and tell which is the Globe, which the Cube? To which the acute and judicious Proposer answers: Not. For though he has obtain'd the experience of how a Globe, how a Cube affects his touch; yet he has not yet attained the Experience, that what affects his touch so or so, must affect his sight so or so. Or that a protuberant angle in the Cube, that pressed his hand unequally, shall appear to his eye, as it does in the Cube. (Letter from Molyneux, cited by Locke, 1690/1975, p. 146)

Locke agreed with Molyneux's intriguing proposition that a person born blind and made to see would not be able to distinguish the cube and sphere by sight for some time. That person would need to experience the visual world before generating ideas based on visual sensations. Locke wrote:

> I agree with this thinking Gent., whom I am proud to call my Friend, in his answer to this his Problem and am of the opinion, that the Blind Man, at first sight, would not be able with certainty to say, which was the Globe, which the Cube, whilst he only saw them. Though he could unerringly name them by his touch, and certainly distinguish them by the difference of their Figures felt. (Locke, 1690/1975, p. 146)

As early as the eighteenth century, surgeons who learned to remove congenital cataracts provided dramatic tests of Molyneux's proposition. In 1728, an English surgeon, William Cheselden (1688–1752), reported to the Royal Society his observations of a young gentleman, born blind, whose sight was surgically restored when he was between 13 and 14 years of age. At first the boy was unable to name anything he saw, but apparently he could distinguish shapes and was able to learn their names. After handling a cat, he looked at it attentively and said, "So puss! I shall know you another time" (Chesselden, quoted by Morgan, 1977, p. 17). A number of such eighteenth-century cases were discussed by Denis Diderot (1713–1784) in his *Letter on the Blind for the Benefit of Those Who See* (1749). Diderot's letter ends with a poetic affirmation of our ignorance of ultimate reality, for which he was thrown into a dungeon in Vincennes on orders of the king of France.

In 1910, a surgeon named Moreau summarized his experiences with an 8-year-old boy "born blind and made to see":

> It would be an error to suppose that a patient whose sight has been restored to him by surgical intervention can thereafter see the external world. The eyes have certainly obtained the power to see, but the employment of this power, which as a whole constitutes the act of seeing, still has to be acquired from the very beginning. The operation itself has not more value than that of preparing the eyes to see; education is the most important thing. (Moreau, 1910, in von Senden, 1960, p. 160)

Support for Locke's answer to Molyneux's question can be found in Maurice von Senden's (1960) summary of the visual experiences of sixty-five congenital cataract patients whose vision was restored. In general, such people do not experience the orderly visual world of the sighted person. At first, they are confused by unfamiliar visual stimuli and can identify familiar objects only by touch. Initially they respond to mirrors as if confronted by another person and react to mirror space as though it were real. Associations between visual sensations and the names of objects must be formed through experience. In many cases, these associations are formed only with great difficulty. Richard Gregory (1974) described the case of S. B., a 52-year-old man who recovered his vision through corneal grafts to both eyes. Before the surgery, this intelligent, active, and curious man worked as a skilled machinist. Afterward he became confused, depressed, and unable to work. He was never able to adjust to a visual world and committed suicide two years after the operation.

Locke's immediate successor within British empiricism was George Berkeley. In our consideration of the history of psychology, we will encounter a number of pupils or successors who adopted more radical views than those of their teachers or predecessors. That was certainly true of Berkeley, who might be said to have out-Locked Locke.

George Berkeley (1685–1753)

George Berkeley was a brilliant and precocious child who entered Trinity College, Dublin, in 1700 at the age of 15 and wrote a treatise on Euclidean mathematics before he was 20. Though he was deeply influenced by Locke, Berkeley's intellectual development followed a different course. Locke wrote his most important work, the *Essay Concerning Human Understanding*, when he was in his late 50s; Berkeley made his most important and creative contributions while he was in his 20s. He was well aware of this difference and rather arrogantly speculated about how it had been possible for Locke to write such an important work at the advanced age of 57.

Berkeley was a formidable and forceful writer. He published his three most important works within four years: *An Essay Towards a New Theory of Vision* in 1709, *A Treatise Concerning the Principles of Human Knowledge* in 1710, and *Three Dialogues Between Hylas and Philonous* in 1713. Berkeley presented a radical extension of Locke's philosophy that has come to be called *subjective idealism* or *immaterialism.* In agreement with Locke, he argued that all knowledge of the external world comes from a single source: experience. But then Berkeley took an additional step and asserted that the very existence of the external world depends on perception. Matter, according to Berkeley, does not exist in and of itself; it exists because it is perceived. His assertion is summarized in the Latin formula *Esse est percipi* (To be is to be perceived). To understand Berkeley's position, one can retrace his arguments using a familiar object, an apple. Both Locke and Berkeley argued that all we know of the apple originally comes from our sensations: what we see, smell, taste, feel, and experience in the presence of the apple. But Berkeley went on to claim that the very existence of the apple depends on its being sensed or perceived, and further that the existence of the whole world depends on the same requirement. The "mighty frame" of the world would not exist without a mind to perceive it (Berkeley 1709/1820, p. 1).

Bertrand Russell captured the essence of Berkeley's assertion in this exchange between a skeptical observer and a subjective idealist:

> You look out of the window, and observe that you can see three houses. You turn back into the room and say, "Three houses are visible from the window." The skeptic would say, "You mean three houses *were* visible." You would reply, "But they can't have vanished in this little moment." You might look again and say, "Yes, there they are still." The skeptic would retort: "I grant that when you looked again they were there again, but what makes you think they had been there in the interval?" You would only be able to say, "Because I see them whenever I look." The skeptic would say, "Then you ought to infer that they are caused by your looking. You will never succeed in getting any evidence against this view, because you can't find out what the houses look like, when no one is looking at them. (Russell, 1940, p. 286)

The assertion that matter does not exist without a mind is a bold one and is obviously important for psychology, a discipline that was defined initially as the science of the mind. However, Berkeley's assertions invite ridicule and misinterpretation because they appear to contradict "common sense." Berkeley was aware that his work might elicit such a reaction, so he deliberately omitted all mention of the nonexistence of matter from the title page, dedication, preface, and introduction of the *Treatise.* He begged his reader to "suspend his judgment" until the book had been read as a whole. His hope was that the notion might "steal unawares on the reader," who possibly never would have read the book had he or she known it contained such paradoxes (Berkeley, 1710, in Luce & Jessop, 1949, p. 23). Alas, such was not the case. When the *Treatise* was published in Dublin (1709) and in London (1711), Berkeley was accused of wildness, of solipsism (the philosophical idea that only the self can be proved to exist), and of having perpetrated a "reduction to an absurdity."[15] Leibniz,

[15] *Reductio ad absurdum.* A reduction to an absurdity; the refutation of a proposition by demonstrating the inevitably absurd conclusion to which it would logically lead (RHDEL, p. 1204).

who we will meet later in this chapter, accused him of seeking notoriety with his paradoxes; the philosopher Samuel Johnson refuted Berkeley's assertion that matter does not exist by kicking a stone and implying that a similar experience would clear Berkeley's head of such fuzzy thinking.

In a number of letters (Luce & Jessop, 1949, pp. 271–294), Johnson further questioned Berkeley's assertion that things exist only when perceived, citing the example of a fire. When we light a fire and then leave the room, no created mind perceives it for some time; yet when we return, a great deal of fuel has been consumed. Surely we must conclude that the fire continued to burn, that is, to exist during our absence. Or consider the tree in the garden; does the tree not continue its existence when the garden is deserted? The birds that nest in the tree would certainly be surprised by an assertion that it does not. Berkeley replied to such ingenious criticism by stating that the fire continues to burn and the tree to exist when there is nobody to perceive them because they continue to be perceived in the infinite mind of God. Berkeley regarded the very permanence of the material world as definitive proof of God's existence, a proof he hoped would counter the skepticism he believed to be an inevitable consequence of the Newtonian view of the universe as nothing more than a giant automatic machine. In the twentieth century, this phase of his thinking was neatly captured in the following limerick by the theologian Ronald Knox concerning a tree in one of the quads of Balliol College, Oxford:

> There was a young man who said, God
> Now doesn't it seem to you odd
> That this great chestnut tree
> Simply ceases to be
> When there's no one about in the quad?

To which the reply takes the form of a letter:

> Dear Sir,
> It really is not at all odd
> I'm always about in the quad
> And the great chestnut tree
> Never ceases to be
> In the mind of Yours Faithfully,
> God.
> (Landa, 1981, p. 22)

Most of Berkeley's contemporaries were neither as witty nor as understanding. His views were regarded as absurd, an exercise in philosophical futility.

While his *Treatise* is open to criticism, it is generally agreed that the theory Berkeley outlined in *An Essay Towards a New Theory of Vision* is an outstanding argument in the classical debate between *nativism* and *empiricism.* The book may also be regarded as the first work in physiological optics, a discipline defined by Hermann von Helmholtz (Chapter 3) a century and a half later. Berkeley's concern in the *Essay* was visual perception, especially the problem of accounting for depth perception. In the *Dialogues,* Berkeley had posed the problem:

> It is, I think, agreed by all that Distance of itself and immediately, cannot be seen. For distance being a line directed endwise to the eye, it projects only one

> point in the fund [retina] of the eye—which point remains invariably the same, whether the distance be longer or shorter. (Berkeley, 1709, 1820, vol. 1, p. 237)

But perception of distance is a skill we are able to use, often in a remarkable way. Think of applying the brakes on a car to make a smooth stop at a traffic light or to follow a slower vehicle. Given that we obviously perceive depth, how do we do it? Berkeley's answer was that we learn to use certain depth cues through experience. He described a number of these cues: interposition—we judge objects that partially or completely hide other objects to be nearer; relative size—we perceive larger objects to be nearer; chiaroscuro—the gradations of light and shade artists often use to suggest depth in their paintings; and finally, movement of the eyes as objects move toward or away from us. Berkeley's description of this last cue is especially explicit. He writes:

> It is certain by experience, that when we look at an object with both eyes, according as it approaches or recedes from us, we alter the disposition of our eyes, by lessening or widening the interval between the pupils. This disposition or turn of the eyes is attended with a sensation, which seems to me to be that which, in this case brings the idea of greater or lesser distance into the mind. (Berkeley, 1709/1820, vol. 1, p. 241)

Had Berkeley made experimental tests of his theory of vision, as contemporary psychologists have, he would have found empirical support for his theory and would also have been the first experimental psychologist. Instead, discouraged by the often hostile reactions to his work, Berkeley turned to other concerns. In 1720, he became involved in founding a university in the New World away from what he considered the degeneracy of the Old. His aim was "converting the savage Americans to Christianity by a College to be erected in the Summer Islands, otherwise known as the Isles of Bermuda" (Berkeley, 1709/1820, vol. 1, p. VII). He used his charm and influence to secure a royal charter for the university, contributed by the Prime Minister of England, and a promise of a parliamentary grant of several thousand pounds. Berkeley left England with high hopes, settling for what he hoped would be a brief interim period in Newport, Rhode Island. Alas, in his case, out of sight was out of mind, and his support slipped away. Parliament reneged on its promise, as did many of his supporters. His visionary project failed, another acute disappointment for Berkeley.

Ironically, Berkeley's most successful work was a book published in 1744 about the curative properties of tar water and several philosophical topics including proofs of the existence of God. *Siris,* as the book was called, described how the resinous exudation of pine and fir trees could cure a wide variety of bodily complaints. Having used it to treat his own ailments, Berkeley became convinced that it was beneficial. Unlike many of his other publications, this book was widely read and went into six editions.

Berkeley lived in America for just two and a half years, but he always retained his admiration for the New World. In his will, he bequeathed his library to Yale University and made a generous bequest to Harvard College. The California city of Berkeley is named after him. He died in Oxford in 1753, and even in death caused many people to shake their heads and dismiss him as an eccentric, if not worse. Berkeley believed that putrefaction is the only infallible sign of death, so he left specific instructions in his will that after death, his body was to lie unwashed, undisturbed, and covered by the same bedclothes, until it became offensive. Such instructions struck many people as bizarre, but today, beset as we are by the acute difficulty of defining death in cases in which life-support systems make it possible to prolong biological life for extended periods, Berkeley's position appears more reasonable. Above all, Berkeley was himself a paradox. Clearly he had a powerful and original mind, but all too often he was dismissed as an unreliable eccentric.

A SEVENTEENTH-CENTURY NATIVIST COUNTERVOICE

Locke and Berkeley were influential voices in seventeenth- and eighteenth-century philosophy, but they were not the only voices; they had critics and opponents. The most important countervoices came from a number of European philosophers who considered themselves *nativist* successors to Descartes. One such man was Gottfried Wilhelm von Leibniz.

Gottfried Wilhelm von Leibniz (1646–1716)

Leibniz was Locke's contemporary; the two men knew each other and often corresponded. Leibniz, known for his political writings, was also Germany's leading mathematician, renowned for his invention with Newton of the calculus, though Newton was never able to accept the fact that Leibniz had conceived of the calculus independently of Newton's work.

Leibniz considered Locke's *Essay* one of the most beautiful and estimable works of the period, but he also believed that Locke's description of the human mind as characterless white paper was wrong. After reading a prepublication draft of Locke's *Essay* in 1688, Leibniz immediately began a rebuttal, his *New Essays on Understanding*. These essays were completed in 1704, the year of Locke's death, but Leibniz withheld their publication as he had no wish to appear critical of a dead man he admired so much. They remained unpublished until in 1765, nearly fifty years after Leibniz's death.

Leibniz could not accept Locke's *empiricist* concept of the contents of the mind. He admitted that animals might be *empirics,* that is, blank tablets at birth later filled by experience, and he described a number of examples in which animals were clearly products of their experience: a dog thrashed with a cane, for instance, will whine and run away at the sight of the cane. Leibniz admitted that humans might be such *empirics* in three-quarters of their acts, but not in all of them. We expect that the sun will rise tomorrow, that the rain will fall from the sky, and that summer will follow spring because of experience. But in addition to this *empirical* knowledge, Leibniz believed, there are necessary and eternal inborn truths, the *nonempiric* one-quarter of the mind that represents the *innate* intellect. Locke and Berkeley had stated that nothing is in the intellect which was not first in the senses. To this Leibniz replied that nothing is there except intellect itself. According to Leibniz, intellect allows reason and science; it gives us knowledge of ourselves and of God and is the essence of the human spirit. A contemporary psychologist, Robert Ornstein, writing on the evolution of consciousness, brilliantly captures the essence of Leibniz's reservations regarding "blank tablet" accounts of the human mind:

> To give Locke's ideas a test, I went to an office supply shop and bought a piece of writing paper and let it sit on my desk for a couple of weeks. And I talked and sang to it. I told it to do all sorts of things. I gave it food, I gave it water. I read to it the works of Descartes, I gave it the works of Freud, I tried to get it to talk, I tried to take it for a walk. I put it in my car to see whether it could recognize the ocean as well as the mountain. The paper was unable to do any of these things. And anyone, for centuries, could see the silliness of claiming that all there is to the mind is associations. (Ornstein, 1991, p. 68)

Leibniz believed that empiricist philosophers made a fundamental error when they denied the existence of inborn ideas, truths, dispositions, habits, and potentials.[16] Rather than a sheet of blank paper that experience writes upon, asserted Leibniz, the mind at birth is a block of veined marble. The veins represent the mind's inborn dispositions. The sculptor's hand frees a figure from this marble, but the figure was present before the chisel was ever lifted. So, too, ideas are present in the mind at birth, and the role of experience is to allow them to emerge.

In his book *The Monadology,* Leibniz described a system of monads—an infinite number of elements composing all being and activity. Monads are indestructible, uncreatable, and immutable. They have no parts and cannot be formed or decomposed. Both the physical and mental worlds were, for Leibniz, vast pluralisms of independent monads.[17] Mental monads have different levels of activity, so there is a continuum of consciousness-unconsciousness from mental events that are totally conscious to others that are fully unconscious. At some point on this continuum, there is a threshold level at which the status of a mental event changes. Leibniz's idea of a threshold of consciousness was to play an important part in psychology, first in psychophysical investigations of the absolute level of stimulation needed to produce a sensation (Fechner, Chapter 6) and later in Freud's conception of the conscious and unconscious mind (Chapter 8).

Though monads may appear to have an effect on one another, they do not interact, but rather follow parallel courses. In describing the parallelism of monads, Leibniz used his famous clock metaphor:

> Imagine two clocks or watches which agree perfectly. Now this may take place in three ways. The first consists in a mutual influence; the second is to have a skilled workman attached to them who regulates them and keeps them always

[16] The *Devil's Dictionary* comments: "The doctrine of innate ideas is one of the most admirable faiths of philosophy, being itself an innate idea and therefore inaccessible to disproof, though Locke foolishly supposed himself to have given it a black eye" (Bierce, 1985, pp. 67–68).

[17] The *Devil's Dictionary* gives a witty description of the qualities and personality(!) of monads: "The ultimate, indivisible unit of matter. According to Leibniz, as nearly as he seems willing to be understood, the monad has body without bulk, and mind without manifestation—Leibniz knows him by the innate power of considering. He has founded upon him a theory of the universe, which the creature bears without resentment, for the monad is a gentleman. Small as he is, the monad contains all the power and possibilities needful to his evolution into a German philosopher of the first class—altogether a very capable little fellow" (Bierce, 1958, p. 88).

in accord; the third is to construct these two clocks with so much art and accuracy as to assure their future harmony. (Leibniz, 1695, in Rand, 1912, p. 219)

Leibniz believed that God had constructed the human body and the mind like two parallel clocks, a psychological parallelism. For him, the mind was an active agent, and his view might be described as an "activity psychology." As we will see, his position came to influence later theorists of "act" psychology (Chapter 6). Leibniz's view was that of an avowed *nativist,* or one who believes in *innate* ideas, tendencies, and dispositions. We encountered nativism previously in the philosophies of Plato, Socrates, and Descartes, and we will meet it again in the psychologies of Francis Galton and Granville Stanley Hall (Chapter 9) and Lewis Terman (Chapter 11).

EIGHTEENTH-CENTURY ASSOCIATIONISM

The ideas of David Hume and David Hartley may be considered transitional between those of the *British empiricists* and *British associationists.* Whereas the early empiricists had analyzed the mind into component parts, Hume and Hartley began the search for laws that would describe how these parts come to connect or blend together in *associations.*

David Hume (1711–1776)

David Hume was born in Scotland and was educated at the University of Edinburgh. As a student he was interested in the science of mental life, called at the time *pneumatic philosophy,* that is, philosophy concerned with expressions of the vital life force the Greeks called *pneuma.* In pneumatic philosophy, humans are considered a part of the world of nature and so should be studied by the methods of natural science. Pneumatic philosophy involved a study of mental life and an attempt to establish the principles underlying mental operations. Hume's two most important works for psychology were *A Treatise of Human Nature* (1739) and *An Enquiry Concerning Human Understanding* (1748). These books were only mild successes, not nearly popular enough to satisfy the intensely self-critical Hume or to secure an academic position for him. Twice he unsuccessfully sought chairs of pneumatic philosophy. He then turned to politics and diplomacy, holding a variety of positions that culminated in his appointment as undersecretary of state. In 1716, Hume published a *History of England,* a work that was a success and did make him famous—though not, of course, as a philosopher.

In the *Treatise,* Hume distinguished between impressions and ideas. He considered these two mental contents different in the degree of force or liveliness with which they impinge upon the mind. Ideas, for Hume, are faint copies of impressions, many of which come from sensations. Sensing is almost everything. For Hume, *senso ergo sum* (I sense, therefore I am). According to him, there is a causal connection between impressions and ideas; when they occur together, they become associated, and the idea comes to resemble the impression. Hume stated that simple ideas combine in the mind to form complex ones according to three laws or principles of association: resemblance, contiguity in either time or space, and cause-and-effect relationships.[18]

In the introduction to the *Enquiry,* Hume advocated a new science of human nature apart from philosophy. Since human beings are part of the world of nature and must be studied using the methods of natural science, systems of ethics, political behavior, criticism and reason, and moral behavior could all be described and explained. All of these Hume considered to be natural products of mental processes, and thus open to scientific study. His essay had little impact on his peers, but his suggestion for a new science of human nature prepared the way for Wundt's establishment of a science of the mind over one hundred years later.

David Hartley (1705–1757)

David Hartley's most important work for psychology was *Observations on Man* (1749). Hartley was trained as a minister of the Church of Scotland (Presbyterians), but when he found himself unable to accept certain theological doctrines, he turned to medicine. As might be expected from a medical man, his orientation was by far the most physiological among the British associationists. Both mind and body are to be studied, Hartley said, because they are related biologically. He specifically localized mental faculties in the brain, pointing out that

> the perfection of our mental faculties depends upon the perfection of this substance (the white medullary Substance of the Brain); that all injuries done to it affect the trains of ideas proportionably; and that these cannot be restored to their natural course till such injuries be repaired. Poisons, spirituous liquors, opiates, fevers, blows upon the head, etc., all plainly affect the mind by first disordering the medullary substance. And evacuations, rest, medicines, time, etc., as plainly restore the mind to its former state, by reversing the foregoing steps. (Hartley, 1749/1912, p. 317)

Some of Hartley's observations were remarkably accurate. He described positive afterimages for both visual and auditory stimuli: the impression of a candle that continues after the flame is out, the impression of a note that continues after the chord is no longer struck. Why do we have such afterimages? Hartley held that objects in the external world act upon our sense organs, causing infinitesimally small medullary particles to vibrate in the nerves and then in the brain. These vibrations continue for a brief time after the stimulus is no longer present; hence, the afterimage.

In the brain, vibrations and ideas become associated by occurring simultaneously a sufficient number of times. In his Proposition XI, Hartley described this reverberatory process:

> Any Vibrations A, B, C, etc., by being associated with one another a sufficient Number of Times, get such a Power over a, b, & c, the corresponding miniature Vibrations, that any of the vibrations A, when impressed alone, shall be able to excite in the Mind, b, c, etc., the Miniatures of the rest. (Hartley, 1749/1912, p. 325)

[18] Hume's complex, intricate theory of causality is often considered his most important contribution to philosophy. A. J. Ayer in *Hume* (Chapter 4) gives a clear outline of Hume's view of causation.

For Hartley, such *associations* were basic to all ideas, opinions, and affections. Hartley's brand of associationism has a biological basis not found in the theories of his predecessors or those of the associationists who followed him. He had drawn on his clinical experiences as a doctor and biological scientist; such experiences were unavailable to other philosophers of the time. Hartley's work anticipated a branch of psychology that was not to be established for more than a hundred years—physiological psychology.

NINETEENTH-CENTURY ASSOCIATIONISM

There were three important associationists in the nineteenth century: James Mill, his son John Stuart Mill, and Alexander Bain. Their wide-ranging interests included many of the topics that later were to form part of the field of psychology. All three men were concerned with social problems and social reform. The Mills, in particular, were liberal activists who influenced the domestic and colonial policy of England through their many books, journals, and periodicals.

James Mill (1773–1836) and John Stuart Mill (1806–1873)

John Stuart Mill began his autobiography with the statement "I was born in London on the 20th May, 1806, and was the eldest son of James Mill, the author of *The History of British India* (Mill, 1873, p. 1). In this remarkable statement there is no mention of his mother, nor does she appear anywhere else in his autobiography. Mazlish (1975) pointed out that in this new version of an immaculate conception, both the history and the boy appear to have been produced by James Mill alone. The relationship between father and son is of great psychological interest.

James Mill was born in 1773, the son of a Scottish village shoemaker. His proud and ambitious mother dominated his early life, insisting that he devote himself to work and study. Study was his only occupation, and so James Mill, like his son, had no childhood friends. Under the patronage of Sir John Stuart, after whom John Stuart Mill was to be named, James entered the University of Edinburgh to study for the Presbyterian ministry. Licensed as a preacher in 1799, James Mill was unable to find a parish because, as Edwin G. Boring (1957) explained, his congregations could not understand his sermons. He spent the next three years as an itinerant preacher before becoming disillusioned with a religious career and immigrating to London. Taking care to lose his Scottish accent, Mill quickly became a member of a group of English writers and editors. To secure a position with the British East India Company, he set out to write a *magnum opus,* or great work, on the history of British India. He began the book in 1806, the year his first child, John Stuart, was born, and hoped to write the history in two years. Actually, it took him twelve years to finish—the years of his son's boyhood. His marriage, which initially had been happy, began to founder as he came to regard his wife, Harriet, as an unintelligent housewife and to disparage her both at home and in public. Despite his apparent disdain for his wife and the fact that he was one of the earliest advocates of birth control, he fathered eight more children. Mill's *History*, published in 1817, was well-received and enabled him to secure a senior position as a civil servant with the East India Company. He soon became financially secure, well known for his writing, and a friend of the rich and influential. However, the years during which he wrote the book and raised John Stuart must have been filled with tension and anxiety.

In his *Essay on Government,* published in 1820, James Mill presented a powerful argument for democratic government. He argued that people are motivated by self-interest and will strive to advance their own interests, even at the expense of others, unless some higher authority restrains such actions. That authority, for Mill, must be a democratically elected government, elected by and accountable to the people. But *not all the people.* Mill did not extend political rights to women; their interests would be represented by their fathers or husbands. As we shall see, his son John Stuart Mill held more progressive views on the political rights of women.

Above all else, James Mill was dedicated to the ethic of hard, unremitting work. He regarded himself as a successful, self-made man. Relentlessly he impressed on his son the belief that a person who works more than others will in the end excel all others. Influenced by the educational philosophy of Locke, James Mill believed that all children are born alike, with little variation in their potential for learning. He felt that the child's mind is indeed a blank tablet or clean slate, on which teachers can imprint anything they wish. As his son's teacher, he dedicated himself to imprinting the maximum amount of knowledge upon John Stuart's mind. The two devoted four or five hours a day to the boy's lessons. In his characteristically dry prose, John Stuart Mill later recalled those years:

> A considerable part of almost every day was employed in the instruction of his children; in the case of one of whom, myself, whatever may be thought of his success, he exerted an amount of labor, care, and perseverance rarely if ever employed for a similar purpose, in endeavoring to give according to his own conception the highest order of intellectual education. (Mill, 1873/1961c, p. 37)

Indeed he did. James Mill regarded his son as a child prodigy and expected him always to behave as such. Failure to perform at the very highest level earned him harsh criticism. So constant was his father's criticism that as a boy, John Stuart concluded he was somewhat backward. Starting with Greek at the age of 3 and Latin at 5, John Stuart worked through classic texts in the original languages. He studied literature, history, mathematics, and politics, receiving one of the most rigorous educations on record. At the age of 11 he published his first serious writing, a work on Roman government that focused on the struggle between the Roman plebeians and patricians. His sympathies were clearly with the plebeians, anticipating many of his later works advocating for the rights of the common people and undermining the power of the English aristocracy. His childhood letters show that John Stuart Mill was incredibly precocious. At age 12, his educational level was probably comparable to that of the best university graduates.[19]

[19] James Mill was instrumental in founding the University of London, which, when it opened in 1828, was the first British university open to all.

John Stuart Mill.
(The Bettmann Archive)

Despite these achievements, John Stuart found that this rigorous education had negative aspects. John Stuart Mill was never allowed to act like a boy. Since he had no playmates, he never learned to play. Even his relationship with his brothers and sisters was unusual, since his father appointed him at the age of 8 to be their tutor and held him responsible for the progress of their education. The emphasis was always on hard work and cold rationality. Feelings and emotions were considered irrelevant, and their expression was actively discouraged. James Mill set out to make his son a "reasoning machine," and it appears, at least for the first twenty years of the boy's life, that he succeeded. At the age of 18, John Stuart Mill described himself as "a dry, hard, logical machine," a description that his contemporaries verified as accurate.

In 1823, at the age of 17, John Stuart accepted a position as a clerk, working under his father at the East India Company. He remained with the company until 1858, when he retired as chief of the office of the examiner of Indian correspondence. Soon after he accepted the position, the cold, hard, logical machine began to fall apart. In 1826, he suffered a severe mental crisis characterized by profound depression, an inability to work, and acute feelings of worthlessness. This period of crisis lasted until he was in his middle 20s, when he slowly recovered, emerging with increased self-awareness and a recognition of the importance of feelings and emotions. The younger Mill saw the need to recognize the irrational as well as the rational, to see that humans are something more than unfeeling machines. However, throughout his life he was troubled by feelings of depression.

John Stuart Mill and the Rights of Women

In the eighteenth and nineteenth centuries, the rights of women in Britain and the United States were severely restricted. Women were expected to devote

A Cold, Calculating Machine

Characters who act as emotionless, calculating machines are common in literature. One of the most famous and striking is Sherlock Holmes. His creator, Sir Arthur Conan Doyle, introduced the great detective through Dr. Watson's voice in the first paragraph of his first adventure, *A Scandal in Bohemia,* published in *The Strand Magazine* of London in July 1891:

> All emotions, and that one particularly (the emotion of love), were abhorrent to his cold, precise, but admirably balanced mind. He was, I take it, the most perfect reasoning and observing machine the world has seen; but as a lover, he would have placed himself in a false position; He never spoke of the softer passions, save with a jibe and a sneer. They were admirable things for the observer—excellent for drawing the veil from men's motives and actions. But for the trained observer to admit such intrusions into his own delicate and finely adjusted temperament might throw a doubt upon all his mental results. Grit in a sensitive instrument, or a crack in one of his own high-power lenses, would not be more disturbing than a strong emotion in a nature such as his (Doyle, 1891/1976, p. 1).

Yet even Holmes eventually fell in love, with Irene Adler, a woman of "dubious and questionable memory."

their lives to home and family, to their husbands and children. Those roles were said to fit their nature. Business, law, politics, medicine, and other activities outside the home were for men:

> In the eighteenth century, in both social and legal terms, the position of women was decidedly inferior to that of men. The legal systems of most American colonies were based on English Common Law that denied women important rights. They were excluded from juries, not allowed to vote, or to sue in court. While single women, needing a certain degree of independence, were able to hold property, the legal status of married women was akin to that of children and the mentally deficient. They were not allowed to own property; legally, all of a woman's property belonged to her husband. This included whatever she inherited or brought into the marriage, her wages if she worked outside the home, and even the clothes on her back. (Klosko & Klosko, 1999, pp. 1–2)

The first great work asserting equal rights for women was Mary Wollstonecraft's *A Vindication of the Rights of Women,* published in 1792. Wollstonecraft (1759–1797) was from a poor family. She supported herself as a governess and seamstress while writing novels and nonfiction works. She died in 1797 at the age of 38, shortly after giving birth to her daughter Mary Wollstonecraft Shelley, the future author of *Frankenstein.* Wollstonecraft conceded the greater physical strength of men but challenged the idea that men and women have different special natures. She believed in a common human nature for both sexes. How that nature is manifested depends upon circumstance and opportunity, and the latter should be equal for men and women. Wollstonecraft wrote: "Let women share the rights, and she will emulate the virtues, of man; for she must grow more perfect when emancipated, or justify the authority that chains such a weak being to her duty" (Wollstonecraft, 1792, in Klosko & Klosko, 1999, p. 51).

John Stuart Mill accepted and extended Wollstonecraft's vision of women's rights while rejecting the position of his father. He was greatly influenced by Harriet Taylor, a beautiful, vivacious woman he met in 1830. She was married to a very respectable man she found "rather dull" (Neff, 1964, p. 51), the mother of two children and soon to bear a third. To Mill, Harriet Taylor was "the most admirable person I had ever known" (Mill, 1873/1961c, p. 170). Until the death of her husband in 1849, Mill, Taylor, and her husband lived together in a threesome that scandalized their Victorian acquaintances (Hayek, 1951; Kamm, 1977). Beginning in 1830, Mill and Taylor exchanged essays on marriage, divorce, provision for the children of divorced parents, and the rights and roles of women. In 1851, two years after the death of her husband, they married. Harriet Taylor died in 1858. As a tribute to his late wife, whose influence he acknowledged and celebrated, John Stuart Mill published *The Subjection of Women* (1869). Mill argued that society's treatment of women stifled their ability to develop to their full potential. Descriptions such as his father's, of the nature of women were flawed by their reflection of the status of women at that time, especially their oppression by, and subordination to, men. Women would only be free if given rights equal to those of men. Along with Wollstonecraft's *A Vindication of the Rights of Women* (1792), Charlotte Perkins Gilman's *Women and Economics* (1898), and Simone de Beauvoir's *The Second Sex* (1951), Mill's essay is regarded as one of the great landmarks of the movement for equal social and political rights for women (Rossi, 1970). It is the only such work written by a man.

Mill also had an opportunity to act on his beliefs and to prove that he was not merely an ivory tower theorist. In 1865, he was elected as an independent Member of Parliament in the British House of Commons. The year after his election, Mill was asked to introduce a bill in Parliament extending the right to vote to women. He agreed to do so if 100 signatures could be gathered on a supporting petition. Within three weeks, 1,499 supporters signed the petition. True to his promise, in 1867 Mill presented the first amendment on women's suffrage to the House of Commons. His amendment received only 73 votes but marked the beginning of the movement to gain voting rights for women (Klosko & Klosko, 1999, p. 13). In England, the right to vote was finally extended to women over the age of 21 in 1928.

In the United States, at a convention in Seneca Falls, New York in 1848, Elizabeth Cady Stanton led the call for women's suffrage. But it was to be 72 years before that right was extended to American women. Finally, the long struggle ended:

> And it was in August of 1920 that members of the Tennessee Legislature, after getting rip-roaring drunk in the liquor lobby's hospitality suites, sobered up long enough to make Tennessee the final state needed to ratify the Nineteenth Amendment to the Constitution, giving women the right to vote (Collins, 2002, p. 12).

After the Nineteenth Amendment passed, the American suffragist Carrie Chapman Catt organized the League of Women Voters.

Mill's parliamentary career was short-lived, but he continued to be one of the leading intellectual figures of his time. He championed democracy, free speech, and universal education. During the American Civil War, Mill challenged the assertion that whites had the right to enslave blacks because whites are "born smarter." For Mill, this was another example of his father's discredited position about human nature. The younger Mill believed all individuals, men and women, whites and blacks, are equal. Supporters of slavery, Mill asserted, were doing the work of the devil (Neff, 1964, p. 32). John Stuart Mill died in 1873, leaving a rich legacy of works and a secure reputation as a leading liberal thinker.

The Philosophies of James and John Stuart Mill

How did James and John Stuart Mill influence the development of psychology? James Mill's most important psychological work was *Analysis of the Phenomena of the Human Mind,* published in 1829. He adopted the familiar position that the two basic elements of the mind are sensations and ideas, with ideas being weak copies of sensations. To the classic five senses Aristotle originally proposed—vision, audition, taste, smell, and touch—Mill added muscle sense, which gives rise to muscle sensations (kinesthesis); disorganized sensations such as those resulting from tickling or itching; and sensations from the alimentary canal. He considered sensations from these eight senses the primary elements of consciousness.

Sensations, according to James Mill, lead to ideas. In a classic chapter entitled "The Association of Ideas," Mill described the process by which sensations produce ideas, which in turn give rise to trains or streams of associated ideas:

> Thought succeeds thought; idea follows idea incessantly. If our senses are awake, we are continually receiving sensations, of the eye, the ear, the touch, and so forth; but not sensations alone. After sensations, ideas are perpetually excited of sensations formerly received; after those ideas, other ideas; and during the whole of our lives, a series of those two states of consciousness, called sensations, and ideas, is constantly going on. I see a horse; that is a sensation. Immediately I think of his master: that is an idea. The idea of his master makes me think of his office; he is a minister of state: that is an another idea. The idea of minister of state makes me think of public affairs; and I am led into a train of political ideas; when I am summoned to dinner. This is a new sensation. . . . (Mill, 1829/1912, p. 463)

Mill's description is linear and sequential. It presents a largely passive mind that invites analysis of its elements. External events give rise to sensations, which are followed in consciousness by ideas, then streams of associated ideas. Why are some ideas associated? Why do they occur together? Why did the idea of the horse's master cause Mill to think of the master's occupation? According to Mill, these ideas were associated because many times in the past he had seen this man performing the actions of a minister of state. Mill recognized that some associations are more compelling than others. His three criteria of strength were permanence, certainty, and facility: More permanent associations are stronger than less permanent ones, correct associations are stronger than incorrect ones, and associations that form readily without effort are stronger than those that form with difficulty. When later psychologists began to investigate learning and memory, the factors determining the strength of different associations were their main concern.

James Mill also distinguished between simple and complex ideas. The latter were compounds, aggregates, or what Mill called "concatenations" of simple ideas, conjoined through contiguity. Complex ideas, in turn, could combine with other ideas, both simple and complex, to form duplex ideas, which Mill described as follows:

> Some of the most familiar objects with which we are acquainted furnish instances of these unions of complex and duplex ideas. Brick is one complex idea, mortar is another complex idea; these ideas, with ideas of position and quantity, compose my idea of a wall. My idea of a plank is a complex idea, my idea of a rafter is a complex idea, my idea of a nail is a complex idea. These, united with the same ideas of positions and quantity, compose my duplex idea of a floor. In the same manner my complex ideas of glass, wood, and others, compose my duplex idea of a window; and these duplex ideas, united together, compose my idea of a house which is made up of various ideas. How many complex or duplex ideas are all united in the idea of furniture? How many more in the idea called Every Thing? (Mill, 1829/1912, p. 482)

Indeed, how many more? This passage makes some of the difficulties of this mechanical model of mental compounding apparent. The model needed revision, which John Stuart Mill provided in his *System of Logic* (1843) and his notes for a revised edition of his father's *Analysis,* published in 1869. The younger Mill developed a chemical model of the mind in which simple ideas fuse or coalesce to form complex ideas. He wrote:

> The laws of the phenomena of the mind are sometimes analogous to mechanical, but sometimes also to chemical laws. When impressions have been so often experienced in conjunction, that each of them calls up readily and instantaneously the idea of the whole group, those ideas sometimes melt and coalesce into one another, and appear not several ideas but one. (Mill, 1843/1875, vol. 2, p. 441)

Thus, Mill supplemented his father's theory of mental mechanics with a mental chemistry. For John Stuart Mill, the associative whole of a complex idea is something more than the sum of the simple ideas that compose it. The mind is active and productive. Just as water is more than the simple sum of the properties of hydrogen and oxygen, and just as hydrogen and oxygen can combine differently to produce hydrogen peroxide, which is very different from water, so, too, the complex idea of a house is something more than the sum of simple ideas of bricks, mortar, wood, glass, and other building materials.

John Stuart Mill's most important scientific work was his *System of Logic,* published in 1843. Despite its formidable title—*A System of Logic, Ratiocinative and Deductive, Being a Connected View of the Principles of Evidence and the Method of Scientific Investigations*—the book was a commercial and academic success that secured for the younger Mill an international reputation. Mill considered it the book he was best fitted to write. He was concerned with the study of the scientific process, or metascience, and with defining the assumptions that underlie all the sciences, including the social sciences—economics and psychology. For Mill, psychology was defined as "the science of the elementary laws of the mind," a definition that was adopted by Edward Titchener some sixty years later (Chapter 5). In contradiction to Auguste Comte's[20] view that there can be no science of the mind since the mind can study all phenomena but its own (Comte, 1855/1974), Mill argued that there can indeed be a science of the mind. He grappled with questions that still trouble many psychology students today. Are human actions deterministically caused and subject to psychological laws, or are they qualitatively different from the phenomena characteristic of such sciences as physics, biology, and chemistry? Mill admitted that the science of psychology would be an inexact science, more like meteorology and tidology (the science of tides) than like physics and chemistry. He wrote of psychology:

> It falls far short of the standard of exactness now realized in Astronomy; but there is no reason that it should not be as much a science as Tidology is, or as Astronomy was when its calculations had only mastered the main phenomena, but not the perturbations. (Mill, 1843/1875, vol. 2, p. 433)

But what if psychology does master the perturbations of human actions and the human mind? What if human behavior comes to be as predictable as the speed of falling objects, the appearance of comets, and the circulation of the blood? Mill was well aware of the ethical and moral questions that would then arise. If one day human actions become as predictable as eclipses of the sun and moon, will it be possible for others to change and control the course of those actions? Given such predictability and control, what would become of free will? Would people be responsible for their actions? These are difficult questions. While psychology today is far from the position Mill foresaw, the questions he raised are critical and controversial. Perhaps the uneasy reaction many people have to such questions accounts, at least to some extent, for the hostile response to such works as B. F. Skinner's *Beyond Freedom and Dignity* (1971b, chapter 13). We all like to think we have free will and individual responsibility. To suggest that we may not invites an angry reaction.

John Stuart Mill saw the need for a subdivision of psychology called *ethology.* He defined this field as "the theory of the influence of various external circumstances, whether individual or social, on the formation of moral and intellectual character" (Mill, 1843/1875, vol. 2, p. 457). Today, the word *ethology* refers to "the study of animal behavior in a natural setting" and is associated with investigators such as Konrad Lorenz, Niko Tinbergen, and Karl von Frisch. The modern meaning and approach are both very different from that which Mill intended.

Perhaps Mill's interest in ethology was due to his childhood experiences. What effects might such experiences have on character formation, and how could they be studied scientifically? For Mill, experimental methods are basic to any science. The study of humans, Mill argued, must leave the realm of speculation and become a science of observation and experimentation in its own right. But experimentation on human character formation is ethically prohibited, so what can the psychologist do? Instead of actively manipulating variables to determine their relative effects, Mill proposed a cause-effect analysis: the examination of some variable that occurs naturally—such as education or

[20] In an irreverent aside, James Burke described Comte as "an interesting French thinker, who jumped off a bridge, married a hooker, and started sociology" (Burke, 1999, p. 106).

the lack of it, family size, or social class—and the formulation of generalizations about its effect. Mill believed that these types of observations might lend support for his intuition that different kinds of childhood experience produce different moral characters, yet the procedure would not perpetuate harm. Today, developmental psychologists employ these procedures in their longitudinal studies of children.

Like Hobbes and Locke, Mill had an interest in problems of government, and like those of his eighteenth-century predecessors, his writings in this area reflected a personal view of human nature. In 1861, Mill published *Utilitarians and Utilitarianism.* Earlier, his father's friend and patron, Jeremy Bentham (1748–1832), had argued for *hedonism,* a philosophy that proposes that humans are motivated solely by the desire to seek pleasure and avoid pain. This view had been roundly criticized by, among others, Thomas Carlyle, who had dismissed Bentham's view as "pig philosophy" that might possibly account for the actions of pigs but would certainly not do for humans.[21] Mill argued that hedonism neglected sympathy, caring, compassion, dignity, love of beauty, and many more of the qualities that make us human. In its place he proposed utilitarianism, a philosophy stating that actions are wrong in proportion to the unhappiness they cause for others. This philosophy enjoyed great popularity in the eighteenth century and has adherents today.

Alexander Bain (1818–1903)

The last of the nineteenth-century British associationists we will consider is Alexander Bain. Bain was Scottish, the son of an Aberdeen weaver. His family was poor, and so Bain left school at the age of 12 to work as a piecework cloth weaver in a mill. He continued his self-education at home, teaching himself mathematics and Latin. Eventually, after many difficulties, he was able to enter a university. He was graduated with high honors and moved to London, where he became a friend of John Stuart Mill and a member of Mill's intellectual set. Bain worked as a free-lance journalist until 1860, when, at the age of 42, he finally received an appointment at the University of Aberdeen.

Bain's most important psychological works were *The Senses and the Intellect* (1855), *The Emotions and the Will* (1859), and *Mind and Body* (1873). The first two books were actually one work with a four-year delay between the publication of its parts. The publisher was reluctant to publish the second part of the book because the first part had not been a financial success. In later years, the two volumes were widely read. They went through a number of revisions and for fifty years were the standard British psychological texts. Finally, in 1882, Bain

[21] Bentham has a curious immortality. In his will, he gave detailed instructions for the preservation and use of his body. Following a public dissection of his body for medical colleagues, his skeleton was to be preserved, clothed from his wardrobe, and displayed with his favorite walking stick in a glass case. If his friends wished to remember him, they were to bring him to their reunions. Bentham's instructions were followed to the letter. In 1850 his *auto-icon* was presented to University College of the University of London. There, except for a brief evacuation during World War II, it has been displayed ever since (Marmoy, 1958). The Bentham relic draws hundreds of visitors. Not surprisingly, it has given rise to numerous legends and anecdotes. It is said to attend meetings of the University Council with a note in the minutes, "Jeremy Bentham—present but not voting."

published an informative biography of James Mill, whose work and philosophy he greatly admired.

In January 1876, Bain founded the journal *Mind*,[22] the first psychological journal ever published. For many years he had to support the journal financially to ensure its survival. Sir Francis Galton, William James (Chapter 9), and Bain himself all published important papers in *Mind*. The journal was also important in providing an alternative publication to the journals that were to be founded, edited, and dominated by Wundt and Titchener during the later nineteenth century. The founding of *Mind* was a considerable contribution to the development of psychology as a discipline independent of both philosophy and physiology.

Bain was closer to being what we would consider a psychologist than were any of the philosophers and scholars we have considered thus far. Like Hartley, he was concerned with developing physiological explanations of human actions and thoughts; however, he was far from being a reductionist, as he always held that conscious data are of primary importance. He recognized the importance of inner drives and so developed an active rather than a passive conception of motivation. To Aristotle's classic five senses Bain added the "organic" sense, which provides sensations from our muscles and is closely involved in the coordination of movements.

In accounting for human actions, Bain believed that habits are of central importance. According to Bain, random movements, some of which lead to pleasant and some to unpleasant consequences, form the basis of learning. The former tend to be repeated, and thus a habit develops, while the latter are weakened so that a particular habit does not develop. The similarity to Edward Thorndike's later law of effect (Thorndike, 1911, chapter 10) is clear, and the historical connection from Bain to Thorndike can be traced. Bain influenced an English comparative psychologist, Conwy Lloyd Morgan (1852–1936), who performed early experiments on learning and instinct in chickens. In 1896, Morgan was invited to Harvard University to give a series of Lowell Lectures describing his research on trial-and-error learning. Sitting in the audience was a student, Thorndike, who shortly thereafter began his own important experiments on learning in chickens.

Bain distrusted speculation and "armchair psychologizing." He stressed the importance of observations of the everyday activities of both human beings and animals. Such naturalistic observations were to provide an understanding of human and animal behavior, but Bain was sympathetic to experimental methods and to developmental approaches. In *Emotions and the Will*, he concerned himself with problems of applied psychology: the diagnosis of character through the compilation of case histories and the possibility of devising tests for the assessment of abilities and aptitudes. Bain, who as a boy had been forced to work under a brutal piecework system, argued for enlightened labor practices and particularly for the importance of considering people's capacities and abilities when selecting jobs for them.

[22] *Mind* and many other journals are available online.

AN EIGHTEENTH-CENTURY NATIVIST COUNTERVOICE

Just as Locke and Berkeley had a European opponent in Leibniz, Hume, Hartley, and the two Mills had a countervoice in Immanuel Kant. He was everything they were not: a subjectivist, nativist, rationalist successor to Descartes and Leibniz. The contrast between his philosophy and epistemology[23] and those of the men we have just discussed could not have been greater. Kant was the empiricists' nemesis.

Immanuel Kant (1724–1804)

Kant was born in the university city of Königsberg in East Prussia. He attended school and university there, was appointed to the university's faculty, and spent the rest of his career and life in Königsberg. Despite his fame, it is likely that Kant never traveled more than forty miles from his birthplace. In developing his philosophy, Kant was stimulated by the "beautiful discoveries" of the British empiricists, especially those of Hume, whose books, he said, "woke him from dogmatic slumbers" (Kant, 1781, Introduction). Kant published his *Critique of Pure Reason* in 1781 and his *Critique of Practical Reason* in 1788. These works of critical philosophy established him as the leading German epistemologist and also formed a philosophical counterweight to the British empiricists.

Kant believed that the empiricists might have been correct in saying that knowledge comes from experience, but that they had been absolutely wrong in failing to ask the fundamental question: "How is experience itself possible?" For Kant, that was the transcendental question that must be answered, and the answer he favored was that of a nativist. Kant believed that certain intuitions or categories of understanding are inborn and do not depend on experience. Rather, they frame our experiences; they allow experience to have its effect. Knowledge of this kind he labeled *a priori* (known beforehand), as distinguished from *a posteriori* (known afterward) knowledge derived from experience. Kant settled upon three fundamental categories of the human mind: cognition, affection, and conation (motivation).

In his *Critique of Pure Reason*, Kant described learning one's native language as an example of the interaction between *a priori* and *a posteriori* knowledge. We learn through experience to speak a particular language (*a posteriori*), but the ability to learn any language is a fundamental (*a priori*) attribute of the human mind. The basic error the British empiricists made, Kant argued, was emphasizing the effects of experience while ignoring the fundamental categories of the mind. Other examples of *a priori* knowledge are the concepts of space and time. Space cannot be "thought away" or separated from our minds because it is a fundamental idea that is necessary to all other ideas. Similarly, time is the prerequisite of all perceptions and ideas. Nothing can exist without time. The perception of time going forward is, according to Kant, a completely

[23] *epistemology*, n. A branch of philosophy that investigates the origin, nature, methods, and limits of human knowledge (RHDEL, p. 480).

natural human attribute. He pointed out the difficulty we have in thinking of time moving backward; it is easy to imagine someone growing older, but difficult to imagine someone growing younger. In all, Kant described twelve such intuitions, including cause and effect, reciprocity, reality, existence, and necessity. The higher faculties of knowledge he divided into understanding, judgment, and reason.

Kant's views on the nature of science were influential within German philosophy and later in psychology for many decades. According to Kant, true sciences must begin with concepts established *a priori* on the basis of reason alone. In addition, true sciences deal with observable objects that can be located in time and space. They permit experiments on the phenomena they study, and a true science is able to establish lawful relationships that can be described through mathematical formulations. Kant believed that psychology lacked such a rational conceptual basis and so failed at the most fundamental level to be a true science. He considered human rationality limited and inadequate in dealing with itself. Kant also believed that it was impossible for psychology to conduct true experiments, because observing mental states would inevitably modify the mental states being observed. Kant's views exerted a powerful force that the first generation of German psychologists had to strive against in establishing their science.

While he denied the possibility of a "true" psychology, that is, a psychology that would be both rational and experimental, Kant did accept one legitimate method for psychology: anthropological observations of the actual behavior of people. Wilhelm Wundt (Chapter 4) was to devote the later decades of his life to cultural or anthropological psychology, while John Watson (Chapter 12) was to advocate a psychology concerned solely with behavior.

Kant's *Critique of Practical Reason* is an examination of practical affairs and the formulation of a code of conduct. Duty, for Kant, is sublime, mighty, and fundamental. It is the *categorical imperative* to be obeyed and followed without question. In practical affairs, we must not merely behave to bring the greatest pleasure to ourselves and others, but we must follow the higher obligation of duty as well. In the decades that followed the publication of Kant's *Critique of Practical Reason,* this concept was an important influence on social and political behavior in both Germany and England. A common prayer in Queen Victoria's England was

> We thank thee God for this food.
> We thank thee God for this prayer.
> And we thank thee God above all for the categorical imperative.

Kant led a life that was the epitome of rigid self-control and duty. He never married but lived with a manservant. Kant woke at the same time every day and rose immediately, believing that it was slothful and indulgent to lie in bed. He took his lunch precisely at one o'clock and then went for the same walk along the university's Philosopher's Way. He was a major figure in German philosophy and an important influence on the first generation of German psychologists.

THE IMPORTANCE OF THE RENAISSANCE AND POST-RENAISSANCE ERAS

The Renaissance and post-Renaissance eras made two major contributions to the development of psychology. The Western scientific revolution began with the work of Galileo, Newton, and Harvey, and the scientific tradition that grew out of that revolution emphasized a certain methodology. One must carefully observe and, if possible, quantify phenomena; make mathematical predictions about the effects of certain variables; and verify those predictions empirically. These procedures promised to uncover truth; they became the standards of Western science and so were adopted by early psychologists attempting to establish a science of the mind.

A scientific tradition was not the only thing psychology inherited from the Renaissance and post-Renaissance eras. Psychology also inherited its philosophical foundations. René Descartes set the stage for psychology as a discipline independent of other sciences by stating that the mind is separate from the body and is subject to its own rules and principles. These rules and principles were to be the domain of the later science of psychology. Psychology also received from these eras two major philosophical orientations: *nativism* and *empiricism.* Not only do these orientations still color psychological theory, they have also been instrumental in defining one of the major issues in psychology: Are human characteristics the result of our *nature,* or are they the result of the way in which we have been raised, our *nurture?* From our study of philosophers who have taken either a "nature" or "nurture" view of humankind, it should be evident that one's political experiences and theological orientation keenly influence the side one takes on this issue. Nativism stresses inherited characteristics; it places less emphasis on the environment and consequently takes a more conservative view of the expected outcome of educational experience. This orientation would not be consistent with social reform and political involvement; at least with the two major nativists discussed in this chapter, Descartes and Kant, this was the case.

An empiricist orientation stresses the equal potential of all human beings, the importance of environmental factors on one's development, and the educational process. It is no surprise that it emerged in England during the rise of liberalism in the eighteenth and nineteenth centuries. As we have seen, its major advocates, the two Mills and Bain, were self-made men who emphasized social reform. It is also no surprise that this philosophical orientation would flower in the United States and give birth to *behaviorism,* a position that is only now being countered by contemporary nativist schools of thought.

Pierre-Paul Broca. Localized speech in the left frontal lobe is an area of the brain now called Broca's area.
(Brown Brothers)

CHAPTER 3

Early Studies of the Central Nervous System

Thus far we have been considering the broad, general influences that the development of Western philosophy and science had on psychology. Now we will turn to specific advances in knowledge of the brain and spinal cord that later formed the foundation of physiological psychology. Unlike the largely speculative contributions of the philosophers discussed in Chapter 2, much of this new knowledge resulted from observation and experiment. The development of procedures for studying the brain and spinal cord, and the application of these procedures in both clinical and experimental settings, laid the foundation for an understanding of the structures and functions of the nervous system. For psychology, they provided a basis for understanding sensation, perception, emotion, language, and cognition.

Though our emphasis will be upon the nineteenth century, the brain was studied before that time. In 1507, Pope Julius II commissioned Michelangelo to paint a series of frescoes on the ceiling of the Vatican's Sistine Chapel. Michelangelo resisted the commission. The chapel was a barn of a room, with its ceiling arching 68 feet above the marble floor. "The place is wrong," Michelangelo complained, "and no painter I!" (Coughlan, 1966, p. 116). But papal commissions could not be rejected, so in January 1509 Michelangelo began his labors. In October 1512, the frescoes were unveiled and hailed as among the most transcendent masterpieces of the Italian Renaissance. In *The Creation of Adam,* Michelangelo captures the moment of creation (Coughlan, 1966, pp. 117–123). God and Adam reach toward each other, their outstretched hands and fingers almost touch, and it seems that in that moment the spark of life leaps across the synapse between God and man. But such an interpretation is far from sure. Adam is clearly alive. His eyes are open, his gaze directed, and his arm and hand outstretched. Frank Lynn Meshberger (1990) has proposed a fascinating alternative interpretation. Writing in the *Journal of the American Medical Association,* Meshberger points out a third main image in the fresco. That image was clearly revealed when centuries of soot, dirt, and grime were removed from the fresco in a recent cleaning. Surrounding God is the unmistakable shape and detail of a human brain. Michelangelo's image is strikingly similar to depictions of the medial aspects of the brain from contemporary anatomy texts. Meshberger concludes that Michelangelo's intent in painting this enveloping brain was to show God giving to Adam not life, but intellect.

It is clear from the image Michelangelo painted that he had detailed knowledge of brain anatomy. That knowledge came from his anatomical studies. Such studies were well-known to Michelangelo's contemporaries; often he would request that his patrons support his studies in return for his art. Michelangelo's friend and biographer Giorgio Vasari described one such arrangement:

> For the church of Santo Spirito in Florence, Michelangelo made a crucifix of wood which was placed above the lunette of the high altar, where it still is. He made this to please the prior, who placed rooms at his disposal where Michelangelo very often used to flay dead bodies in order to discover the secrets of anatomy. (Vasari in Bull, 1965, pp. 332–333)

Michelangelo was ahead of his time, for his knowledge of the brain was based upon observation. For more than two centuries after he painted the Sistine frescoes, knowledge of the brain was largely speculative. The influence of Descartes led inevitably to speculation about the seat of the mind and the role of the brain in controlling thought and action. The bloody seventeenth and eighteenth centuries of European war and revolution provided many opportunities to study the consequences of central nervous system trauma as soldiers sustained terrible battlefield injuries to the spine and brain. The ones who occasionally survived were not only treated but studied. Momentary actions were observed even after decapitation; the revolutionary mobs surrounding the guillotine saw grins, winks, and smiles and heard grunts and groans from the heads of the executed. Were such actions intentional? Was a wink or smile perhaps a final gesture of defiance or contempt? These were compelling questions both for the Church, with its doctrine of the flight of the soul from the body at the instant of death, and for French thinkers steeped in the mind-body dualism of Descartes.

Georges Cabanis (1757–1808), a leading French physician, anatomist, and politician, considered such questions and concluded in 1795 that consciousness ends when the head and brain are severed from the body. All thought depends on one "special organ," the brain. The observed actions, Cabanis asserted, were reflexive and automatic. They were no more indicative of continued consciousness than is a headless chicken's flight around the farmyard. A German physiologist, Theodor Bischoff (1807–1882), arranged a macabre, even ghoulish, test of Cabanis's assertion with the head of a newly executed criminal. Even intense stimuli, including the shouted word *Pardon!* elicited no reaction during the first minute after decapitation (Fearing, 1930, p. 152). Cabanis's conclusion was correct.

EXPERIMENTAL INVESTIGATIONS OF SPINAL CORD FUNCTIONS

Because the spinal cord is both structurally less complex and physically more accessible than the brain, it was studied first. In 1751, Robert Whytt (1714–1766), the King's physician and President of the Royal College of Physicians, published *An Essay on the Vital and Involuntary Motions of Animals* in which he reported the results of more than a decade of research. His most important experiments took place with decapitated frogs. Whytt found that a frog without brain and spinal cord was totally unresponsive; but for some time after decapitation, a frog without a brain but with a spinal cord would respond to a pinch by withdrawing its leg. In the English of his time, Whytt described this surprising result:

> When the hinder toes of a frog are wounded, immediately after cutting off its head, there is either no motion at all excited in the muscles of the legs, or a very inconsiderable one. But if the toes of this animal be pinched, or wounded with a pen-knife, ten or fifteen minutes after decollation, the muscles, not only of the legs and thighs, but also of the trunk of the body, are, for the most part, strongly convulsed, and the frog sometimes moves from one place to another. (Whytt, 1751, reprinted in Robinson, 1978, item 12, p. 501)

An intact spinal cord was necessary for these reflex responses. According to Whytt, immediately after surgery the great pain associated with decapitation masks or blocks the reflexes. Once this pain dissipates, the reflexes recover. Whytt's explanation is plausible, though incorrect. But his demonstration of spinal reflexes was of lasting importance. In 1838, an even more puzzling observation was made by Alfred Volkmann: certain reflexes appeared only *after* decapitation (Macmillan, 2000a, p. 191). It was in France and England, during the early nineteenth century, that more progress was made in understanding the structure and function of the spinal cord. That achievement rested on the work of many men, but the predominant contribution was that of François Magendie (1785–1855) (Lesch, 1984).

Since writing his doctoral thesis in 1808, Magendie had thought of the tracts of fibers entering the spinal cord, the spinal cord roots, as ways in and out of the cord itself (Cranefield, 1974). His anatomic findings were initially disappointing, for in most of the species he studied, the roots fused before exiting from the spine and so could be reached only by breaking open the spine. In the days before anesthesia—ether was discovered in 1847—that procedure was excruciatingly painful and almost always damaged the spinal cord. In puppies, Magendie found a different anatomic disposition of the dorsal and ventral roots of the peripheral nerves; they come together outside the spinal column. This meant that the spinal cord roots could be exposed with relative ease in puppies. Magendie cut either the dorsal or ventral roots of one or more nerves and observed specific effects. Following a dorsal root section, part of the body lacked sensation; following a ventral root section, the body part lost its movement. In 1822, Magendie described the results of several such experiments in a now-famous three-page paper published in the French *Journal of Physiology and Experimental Pathology.* He concluded: "The dorsal and ventral roots of the nerves that arise from the spinal cord have different functions, with the dorsal more particularly related to sensation, and the ventral to movement" (Magendie, 1822, p. 279). Magendie's demonstration of the structural and functional specificity of spinal cord roots was comparable in its significance for physiology to Harvey's research on the circulation of blood (Chapter 2). Magendie's systematic experimental investigation made clear the basis of the reflex arc. That behavioral model, with its isolation of sensation and movement, was to provide the later science of psychology with one of its enduring paradigms—that of stimulus and response.

A more immediate consequence of Magendie's publication was a bitter dispute over priority of discovery. In 1811, a Scottish physiologist and anatomist, Charles Bell (1774–1842), had privately published a pamphlet entitled *Idea for a New Anatomy of the Brain; Submitted for the Observation of His Friends* in which he speculated about the functional significance of different parts of the brain and described experiments using rabbits in which he had opened the spine and sectioned either the dorsal or ventral roots. Bell concluded erroneously that ventral roots control voluntary behavior, while dorsal roots control involuntary behavior. But he was correct in labeling the ventral roots as motor. After Magendie's 1822 publication, Bell's son-in-law, John Shaw, challenged the priority of his result. Since Bell had circulated his pamphlet only among his friends, Magendie had not read it. When Shaw sent him a copy, Magendie acknowledged that Bell had come close to discovering the functions of spinal cord roots, but he refused to yield his claim to priority. Bell and his students then began what Gallistel aptly described as "a clamorous, unprincipled, but largely successful campaign to claim priority for what was properly Magendie's discovery" (Gallistel, 1981, p. 359). The success of their campaign is seen in today's textbook references to the Bell-Magendie law. Such an attribution is unfair to Magendie. His experiments were far more complete and definitive than Bell's; Magendie's conclusions were clear, whereas Bell's were diffuse and obscure. Bell unfairly criticized Magendie for the cruelty of his experiments, claiming that his own experiments with "stunned rabbits" were more humane. In truth, the animals in both sets of experiments must have suffered great pain. At times Bell claimed that Magendie's experiments were unnecessary replications of his own. Both charges were seized upon by antivivisectionists and are still cited by critics of animal research and experimentation. Finally, Bell's ethical behavior is open to rebuke, for there is historical evidence that he made certain alterations to his earlier works to support his claim for priority (Olmsted, 1943, 1944). In other respects, Bell is more admirable. In 1815, he served with great courage as a field surgeon at the Battle of Waterloo; and he correctly described *Bell's palsy,* a weakness and paralysis of one side of the face caused by pinching of the seventh cranial nerve. He was knighted Sir Charles Bell in 1831.

SENSORY PHYSIOLOGY

Though Bell's study of the dorsal and ventral roots of the spinal cord was not definitive, he was essentially correct in his argument, presented in 1823, that since nerves intervene between events in the external world and our perception of them, they must influence the quality of our perceptions. Bell believed that each nerve imposes its own specific quality on what we perceive. This doctrine predicts that the same stimulus will produce different sensations if it operates on different nerves. Since it is the nerve that imposes sensory specificity, as long as a particular nerve is active, a particular sensation will result. A powerful stimulus such as a blow to the head produces sensations of pain, flashes of light, and noises because these different sensory systems have all been stimulated. This doctrine also predicts that different stimuli acting on the same nerve should produce the same sensation; since it is the nerve that imposes sensory specificity, a particular sensation will result regardless of how the nerve is stimulated. Thus visual sensations, which usually are the result of stimulation of the eye and optic nerve by light, may result from chemical and electrical stimulation of the nerve itself or from pressing on the eye when the eyelids are closed. These are different stimuli, but they all produce activity in the optic nerve; thus, the sensation is one of light.

This doctrine of specific nerve energies was developed further by the nineteenth-century German physiologist Johannes Peter Müller (1801–1858) in his authoritative 1840 *Handbuch der Physiologie der Menschen* (Handbook of Human Physiology). Müller pointed out quite correctly that the nerves themselves must either communicate different impressions to the brain, or must project to different parts of the brain which themselves impose specificity. At the time Müller regarded proof of either proposition as impossible to attain. Today we know that different sensory projection areas of the brain impose the specific quality.

Hermann von Helmholtz (1821–1894)

Further progress in sensory physiology was led by perhaps the greatest of the nineteenth-century physiologists, Hermann Ludwig von Helmholtz. Helmholtz, the son of a German schoolteacher, was born in Potsdam. He was a precocious and brilliant student who graduated early from his high school and enrolled as a scholarship student in a school that trained surgeons for the Prussian Army. The school's curriculum was rigorous—forty-eight lectures a week, with the first one at 6 A.M. each day—yet the hardworking Helmholtz thrived under this regimen. He even found time to attend the theater, hear recitals of Beethoven and Mozart, read Goethe and Byron, and master the integral calculus. Helmholtz received an M.D. degree in 1842 and then had to satisfy his military obligation by serving as an army surgeon for six years. He was, however, much more interested in research than in practicing medicine, so in 1849 he accepted an appointment as professor of physiology at the University of Königsberg. There he began a long series of brilliant contributions to physiology and physiological optics; one of his technical contributions was the invention of the ophthalmoscope, allowing for the first time examination of the retina under direct illumination. Later he was to publish the definitive nineteenth-century works on physiological acoustics and optics and a still-influential theory of color vision.

The Young-Helmholtz Trichromatic Theory of Color Vision

In 1801, Thomas Young (1773–1829), an English physician and physicist, proposed that color vision was based on three different kinds of nerve fibers, corresponding to Newton's three primary colors—red, green, and blue. In the 1850s, Helmholtz discovered Young's theory and, with English physicist James Clark Maxwell, tested it experimentally. They found, as Young's theory predicted, that subjects could match a light of any color (hue) with some combination of three lights of the primary colors. This theory of color vision has come to be known as the *Young-Helmholtz trichromatic theory of color vision.* Recent physiological studies of the human retina have shown three types of *cones,* each with a different photochemical that makes it most sensitive to light within one of the bands of the three primary colors (Gray, 2002, p. 285). Our color vision is the result of different combinations of these photochemicals. But it is his research on neural conduction that was Helmholtz's most brilliant contribution.

Helmholtz's research occurred against a background of experimentation and speculation on electricity and the nervous system. A seventeenth-century Dutch scientist, John Swammerdam (1637–1680), removed a muscle and attached nerve from a frog's leg. When he pinched the nerve, it caused the muscle to contract. In 1751, after a long series of experiments using frog nerve-muscle preparations, Robert Whytt concluded that "a certain power of influence lodged in the brain, spinal marrow, and nerves, is either the immediate cause of the contraction of muscles of animals, or at least necessary to it" (Whytt, 1751, sec. 1, p. 3). The eighteenth century was the age of electricity, and so it was inevitable that Whytt's "certain power of influence" would be considered to be electrical. In the 1780s, an Italian professor at the University of Bologna, Luigi Galvani (1737–1798), used an "electrical influence" machine to stimulate—or as he said, to irritate—frog muscles. Galvani was familiar with Benjamin Franklin's experiments on electricity. Franklin (1706–1790) began his observations of electrical phenomena in Philadelphia in the 1740s. He concluded that all bodies have a natural quality of electrical fire and carry an electrical charge. Franklin explained lightning as the rapid release of electrical fire and invented the lightning rod to disarm clouds and provide protection from lightning strikes. Franklin's views were controversial, so he proposed a dramatic demonstration:

> A sentry box was to be placed on a high building; a long, pointed rod was to rise out through the door, extending twenty or thirty feet in the air, terminating in a point. That point was to be affixed to the middle of the insulated stand, which was to be kept clean and dry so as to remain as an insulator. (Benjamin Franklin in Cohen, 1941, p. 134)

Franklin predicted that a sentry in such a box would be safe during a thunderstorm. The first sentry box tests were performed in France in May 1752. The sentry emerged from his box unscathed. They were repeated for the King of France and his Court, again with success. Similar demonstrations followed in Germany and England, but not in Russia. In St. Petersburg the participant did not fully observe all of Franklin's safety precautions, and he was electrocuted.

In a second well-known demonstration, Franklin flew his electrical kite into clouds during thunderstorms. These demonstrations showed conclusively that the lightning discharge is an electrical phenomenon. They provided a rational explanation for one of the most frightening and dangerous natural phenomena and a practical application, the lightning rod, which would save lives and property.

Galvani investigated the effects of naturally occurring electricity on muscle contraction. He strung a long wire from the roof of his laboratory to the frogs' vivarium and attached one end to their muscles. When a cloud with its electrical charge passed overhead, the muscles would contract. This demonstration so pleased Galvani that he used it as an after-dinner entertainment for guests. Galvani sought a more powerful source of natural electricity and so tried to capture a bolt of lightning with his wire. He was never able to do so, which was just as well for both Galvani and his frogs. Galvani also observed muscle contractions when he connected a frog muscle between different metals; silver and iron produced the most "vehement reaction." He described his results in his 1791 book *De viribus electritatis in motu muscularis commentarius* (A Commentary on the Role of Electricity in Muscular Contractions). Only twelve copies of the book were printed, as Galvani could not think of any more people who would be interested in this experiment or in his thesis that electricity is inherent to the frog and possibly to all living organisms. Galvani believed that the electricity was generated by the brain and distributed throughout the body by the nervous system. His thesis was soon to be challenged, but his insight that neural activity has an electrical component was important, and psychologists still honor his memory when they speak of the *galvanic* skin response. One challenge came from Alessandro Volta (1745–1827), one of the twelve recipients of Galvani's book. A professor of physics, Volta believed that the electricity Galvani had observed was not inherent to the organism, but bimetallic—that is, caused by a potential or "voltage" difference between the metals attached to the frog. Galvani's frogs, Volta said, had not *generated* electricity, but *conducted* it.

In the early 1840s, Emil Du Bois-Reymond (1818–1896) began his electrophysiological studies of nerve tissue. At the time, there was no device with the sensitivity required to measure electrical activity in the nervous system. Du Bois-Reymond struggled for years with devices he collectively labeled "the brute." Finally, in 1848, he had the great satisfaction of recording the electrical activity of a frog's sciatic nerve. When he placed one wire on a nerve and another on the nerve's sectioned end, he observed the flow of electrical current. Next he tried to measure minute electrical voltages in the muscles of his arms, but he was unsuccessful due to the high resistance of the skin. So Du Bois-Reymond blistered his skin and placed saline-soaked blotting paper on the skin to facilitate conduction. Sensitivity increased some thirty times, and he was able to record electrical activity when he moved his arm (Lustig & Knapp, 1996, p. 82). Until experiments such as these, the nerve impulse had been rather mysterious. Some type of disturbance was known to travel along the nerve, but the nature and speed of the disturbance were unknown. Du Bois-Reymond had shown that this disturbance was electrical in nature. His two-volume *Animal Electricity* summarized what was known about electrical nerve conduction and also developed a polarization theory to account for neuromuscular functions.

Helmholtz Measures the Speed of the Nerve Impulse

Once he understood that the disturbance moving along the nerve was electrical, Helmholtz set out to measure its speed. First he dissected a motor nerve and muscle from a frog's leg. When the nerve was stimulated electrically, the muscle contracted. Helmholtz also invented the myograph, in which the muscle traced its contraction upon a revolving drum. This device could record the latency, duration, and nature of the contraction. The short delay between the stimulation of the nerve and the muscle's contraction was, Helmholtz believed, the time it had taken the electrical impulse to travel along the nerve. Knowing that time, and the length of the nerve, Helmholtz calculated the speed of the nerve impulse to be 25 meters (83 feet) per second. He then trained human subjects to press a button when they sensed a stimulus applied to their legs. Results were variable, but as Helmholtz predicted, reaction times were generally longer for a stimulus applied to the toe than for one applied to the thigh. These experiments were highly significant. For the first time, the speed of the nerve impulse in both frogs and humans had been measured. Earlier estimates had ranged from 9,000 feet per minute to a blindingly fast 57,600 million feet per second. With Helmholtz's observations they had been replaced by precise and remarkably accurate measurements. Today, Helmholtz's experiments are considered to have been a triumph of nineteenth-century research. But initial reactions were more reserved. His results appear contrary to common sense: we believe our sensations to be immediate, not delayed, as Helmholtz's results suggested. When a giraffe stubs its foot, how long would it be before the animal senses the pain? The long distance the sensory nerve impulse must travel to reach the animal's brain suggests an appreciable delay. Yet the animal's reaction appears instantaneous. Even Helmholtz's contemporaries expressed reservations. Du Bois-Reymond commented on Helmholtz's first report of his research: "Your work, I say with pride and grief, is understood and recognized by myself alone. You have, begging your pardon, expressed the subject so obscurely that your report could at best only be an introduction to the discovery of the method" (Koenigsberger, 1965, p. 64). Helmholtz's lectures were no better. His father commented on one of them: "He is so little able to escape from his scientific rigidity of expression . . . that I am filled with respect for an audience that could understand and thank him for it" (Koenigsberger, 1965, p. 65).

Though his style may have been obscure, Helmholtz's work has come to be recognized as one of the crown jewels of nineteenth-century physiological research. His results prompted a host of important questions. First, what is the nature of the nerve impulse? Is it exclusively electrical, or does it have chemical components? Second, do different nerves conduct at different speeds, and do the nerves of different people conduct at different speeds? Third, does the speed of the nerve impulse depend on the intensity of the stimulus? Fourth, are nerves equally excitable at all times? In their attempts to answer such questions, nineteenth-century sensory physiologists made great progress in understanding the nervous system. In 1882, in recognition of his contributions, the German Kaiser elevated Helmholtz to noble rank and Hermann *von* Helmholtz became his new legal name.

But what of the brain and its relation to the mind? Today we regard the brain as the body's canonical organ, the seat of the intellect and of consciousness. At first the brain might seem an unimpressive candidate for such a role: the human brain weighs between 3½ and 4 pounds, appears dormant to the unaided eye, and has the consistency of well-formed Jello. Yet we now know the brain to be the ultimate source of our greatest achievements—Beethoven's symphonies, *Hamlet,* the Declaration of Independence, French Impressionist paintings, and the Golden Gate bridge. But the brain is also the source of

Dachau, Belsen, Adolf Hitler, and Charles Manson. Understanding the brain is the greatest challenge we face. The nineteenth century saw revolutionary changes in conceptions of brain function. For the first time, scientists studied the brain directly and made much progress in understanding its structures and functions. We are still far from a complete understanding, but we have made considerable advances.

PHRENOLOGY

First we must deal with a false start. Phrenology[1] was a remarkably detailed description of brain function that received great popular acclaim in the nineteenth century. For a time, phrenology was an accepted science (*logos*) of the mind (*phrenos*). Despite its carefully built empirical foundation, phrenology was deeply flawed and now has at best the status of a pseudoscience. An examination of the rise and fall of phrenology is instructive.

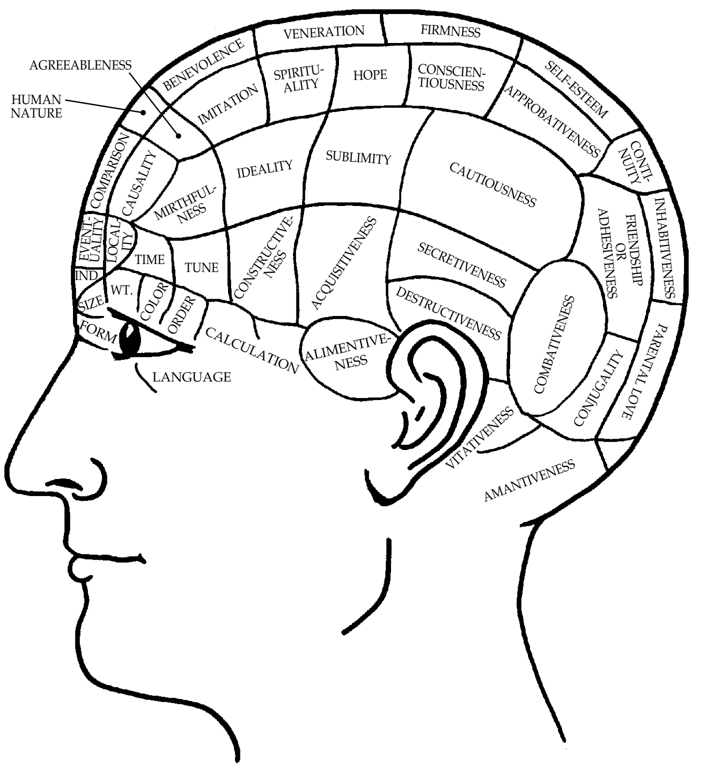
Franz Joseph Gall (1758–1828) and Johann Caspar Spurzheim (1776–1832)

Phrenology began with the work of Franz Joseph Gall. Born in Germany, the son of a small-time merchant and village mayor, Gall qualified as a physician in Vienna in 1785. In Vienna, Gall developed a successful medical practice with many prominent patients and gained a reputation for maintaining a flamboyant, extravagant, and indiscreet lifestyle. He was also highly regarded for his careful anatomical studies and lectured widely, sometimes charging admission to his demonstrations. Gall wrote *A Treatise on the Philosophy of Medicine,* published in 1791. But he is best remembered today for his claims that personality can be inferred from bodily appearance, especially the features of the skull. As a boy, Gall had noticed that a number of his acquaintances with good memories also had large, protuberant eyes. As an anatomist, he speculated that other characteristics might be associated with external features, so he began a systematic evaluation of this idea. Gall believed passionately that precise measurements would lead to an understanding of the person's personality. He traveled to foundling homes, prisons, and lunatic asylums to measure or "read" the skulls of the individuals residing in those institutions. At the same time, he compiled a large anecdotal catalogue of specific mental characteristics associated with particular bumps on the skull. For example, he found a number of convicted pickpockets who all had bumps in the same area on the side of the skull, just above the ear. Gall concluded that this was the brain locus of the acquisitiveness function or power, a function obviously too well developed in the pickpockets. Not content with studying the skulls of the living, Gall also collected the skulls of the dead. So assiduously did he develop his skull collection that many Viennese specified in their wills that "their heads be protected from the researches of Dr. Gall."

[1] A comprehensive website on the *History of Phrenology* is maintained by John Wyhe at the British Library.

As a result of Gall's ceaseless measuring, he gradually developed a "doctrine of the skull" that summarized the enormous body of data he had collected. This doctrine stated that personality and intelligence are reducible to twenty-seven powers or functions, including: the power to propagate, tenderness, valor, moral sense, wit, a sense of God, pride, cunning, larceny, poetic talent, and the power to be educated. Gall believed that each of these powers is localized in a specific surface area of the brain and that the skull encapsulates the brain so closely that skull contours reflect deviations in the surface of the brain. Well-developed powers cause small bumps to appear on the skull; less developed powers may even cause indentations. Consequently, measurement or palpation (examination by touch) of the skull can reveal the strength of the underlying powers. Gall organized the results of such a phrenological reading of the skull into charts, with the strength of each faculty shown on a rating scale.

Gall attracted many followers and supporters, but he also made powerful enemies. The Catholic Church branded his work deterministic and materialistic, which indeed it was, and as having atheistic implications. Gall protested that his discovery of an "organ of religion" had provided a definitive proof of the existence of God. But his protest was to no avail; his books were placed on the Church's *Index of Prohibited Books.* In 1802, the Austrian Emperor Francis I



A phrenological chart locating various mental faculties in specific areas of the skull.

condemned Gall's lectures on the close connection between brain and personality as "subversive of religion and morals" and prohibited him from speaking in public. Gall left Vienna and, after a highly successful lecture tour of Europe, settled in Paris.

Despite the censure of the ecclesiastical and civil authorities, Gall attracted many followers, the most important of whom was Spurzheim. Spurzheim had initially studied theology and then attended medical school in Vienna. He joined Gall as his secretary and assistant in 1804 and left Vienna with Gall a year later. Between 1810 and 1819, they published at Gall's expense four *quarto*[2] volumes and an atlas of one thousand plates describing *The Anatomy and Physiology of the Nervous System in General and the Brain in Particular, with Observations on the Possibility of Discovering the Number of Intellectual and Moral Dispositions of Men and Animals Through the Configurations of Their Heads.* Inexpensive, popular editions without the plates were published in 1822 and 1825. Their aim was to develop a perfect knowledge of human nature based upon study and measurement of the skull. Phrenologists thought of themselves as anatomists and scientists. They were thoroughly contemptuous of armchair philosophers and metaphysicians. But the logic of their arguments was fatally flawed. In one infamous incident, Richard Porson, a celebrated critic and classical scholar, died of apoplexy. He had long been Professor of Greek at the University of Cambridge and was distinguished for his immense erudition, great acuteness and solidity of judgment, intense powers of concentration, and stupendous memory. After his death, his skull was examined, but as a contemporary account stated, "To the consternation of all phrenologists, but to the consolation of all blockheads, his skull was found to be thicker than that of any man that had been dissected in Europe" (*Emerson's United States Magazine,* 1857, p. 155). Dr. Gall was consulted. He agreed that the case was perplexing but concluded, "How so much knowledge could get into such a cranium as that I cannot, indeed, comprehend; but I can well understand that, having once got into it, *it would never be able to get out again*" (*Emerson's,* 1857, p. 155).

Even while collaborating, Gall and Spurzheim had many bitter disagreements that grew out of their different conceptions of basic human nature. Gall had a rather pessimistic and cynical view, even designating one power or faculty "murder." He was very much a determinist who believed that powers are inborn and cannot be changed. Spurzheim's views were more optimistic and utopian. He saw humans as perfectible and phrenology as the science that would show them the way to a happy life. Of the two, Gall was always more the scientist, Spurzheim more the propagandist and promoter.

Gall died in Paris in 1828. The unforgiving Catholic Church denied him burial in consecrated ground, but phrenologists considered it proper to dissect his skull. The anatomists were astonished to discover that his cranium was thicker than any they had seen since the death of Porson—at least twice as thick as any other they had seen (*Emerson's,* 1857, p. 156). Spurzheim was undaunted. With his new colleague, the Scottish phrenologist George Combe (1788–1858), he continued to popularize phrenology. Together they changed the field from

[2] *quarto,* n. A book of about nine-and-a-half by twelve inches, constructed by folding printed sheets twice to form four leafs or eight pages (RHDEL, p. 1176).

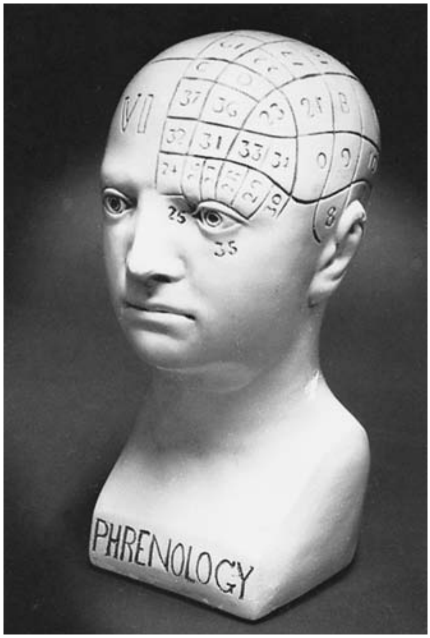
Gall's attempt at a science to a cult. Their demonstrations were often dramatic. In one, magnets were used to "stimulate" a particular power. When a magnet passed over the "veneration area," the person assumed a "worshipful air"; when it passed over the "acquisitiveness area," the subject attempted to pick the pocket of the phrenologist.

Knowledge of this new "science of the mind" spread, and Spurzheim and Combe were invited to lecture in the United States. Spurzheim visited Boston in 1832, and his arrival created a sensation. He gave a series of highly successful lectures and demonstrations at hospitals and universities and attended commencements at Harvard and Yale as an honored guest. As one contemporary observer put it, "The professors are in love with him" (Bakan, 1967, p. 331). Six frenzied weeks after his arrival in the United States, at the time of his greatest popularity, Spurzheim died. His death and funeral were major events, and interest in phrenology increased even more when an autopsy revealed that he had a massive 57-ounce (1,616-gram) brain, some 10 ounces (284 grams) larger than average. What the significance of such a heavy brain was, people were not certain, but surely it could not have been a coincidence.

Following Spurzheim's death, Combe continued to popularize phrenology. He was instrumental in forming more than forty-five phrenological societies in both Europe and the United States, many of which lasted well into the twentieth century. Combe's phrenological text *Constitution of Man* sold over one hundred thousand copies, and some have said that in the nineteenth century many homes contained only three books: the Bible, *Pilgrim's Progress,* and *Constitution of Man* (Young, 1985, p. 64). Combe was elected to the National Academy of Natural Sciences and was offered a professorship of mental and moral philosophy at the University of Michigan. He devoted his life to phrenology, education, and prison and asylum reform and appears to have been dedicated and idealistic in these pursuits. When Combe was asked to justify the existence of slavery on the grounds that his scientific studies had shown that the skulls of black people were "inferior," he refused to do so and stated that an educated slave could compete as a free person. He also attacked the second-class status of women, rejecting claims that they were intellectually or emotionally inferior to men. Sarah Josepha Hale, the author of the well-known verse "Mary Had a Little Lamb" and the editor of *Boston's Ladies Magazine,* said that phrenology was second only to Christianity as a force for the elevation and improvement of the status of women. Very soon, however, as a result of the popularization of phrenology, the focus of the discipline changed. It was no longer an empirical science in the manner Gall had originally defined it.

Phrenology as Big Business

Three enterprising Americans were quick to capitalize on the fadlike qualities of phrenology. Orson and Lorenzo Fowler and a man named Samuel Wells, who married the Fowlers' sister, established the family firm of Fowler and Wells. They marketed every conceivable type of phrenological apparatus and equipment, including busts and heads with neatly lettered and numbered areas and phrenological manuals complete with detailed instructions for phrenolog-



A phrenological bust with neatly numbered locations of different faculties.
(Leonard Lessin/Peter Arnold)

ical self-analysis. In their hands, phrenology became "the science of picking the pocket through the scalp" (Bierce, 1958, p. 99). "Know thyself" was the phrenologists' motto. The best-selling *Phrenological Self-Instructor* (Fowler & Fowler, 1859) was profusely illustrated with "proofs" of phrenology. The good mother has a bump in her parental love area, the unmotherly an indentation. Aaron Burr, who killed Alexander Hamilton in a duel, was tried for treason, and was widely known as a philanderer, is shown as having a large bump in the amativeness (inclination toward love, or amorousness) area. "Miss Modesty," on the other hand, is pictured as having a marked depression in the same area (Fowler & Fowler, 1859, p. 75). Fowler and Wells made extensive lecture and publicity tours, published an amazing amount of literature, and established phrenological parlors in many cities. Their phrenological cabinet in New York City was an emporium with thousands of human and animal skulls.

Fowler and Wells had a great impact on American culture at the time. Some American businesses made phrenological examinations a condition of employment; politicians running for office underwent phrenological analysis and, if the results were favorable, publicized them. Advertisements such as the following from the New York *Sun* appeared in newspapers:

> Apprentice wanted—stout boy not over 15 years of age of German or Scotch parents, to learn a good but difficult trade. N.B.—it will be necessary to bring a recommendation to his abilities from Messrs. Fowler and Wells, Phrenologists, Nassau Street. (Schwartz, 1986, p. 33)

Young people contemplating marriage were urged to consult a phrenologist to learn the laws of conjugal selection and to discover who ought and ought not to marry. Painters and sculptors used calipers to measure their subjects' skulls; women were advised to wear their hair in a bun to display their high, noble foreheads and large domestic faculties, provided those features were prominent (Colbert, 1998, p. 180). Many famous figures had their heads read; Walt Whitman was so pleased with the results of his phrenological analysis that he had it published five times. Phrenological terms and analyses appear frequently in nineteenth-century literature: Charlotte Bronte's heroes have large heads, high foreheads, and wide-set eyes, while villains have narrow heads, beetle brows, and beady eyes. Edgar Allan Poe regularly wove phrenological concepts into his work, and Jane Eyre was said to have an unusually large veneration area. In *The Hound of the Baskervilles,* originally published in 1901, Sherlock Holmes meets Dr. James Mortimer, a member of the Royal College of Surgeons and a phrenology enthusiast:

> You interest me very much, Mr. Holmes. I had hardly expected so dolichocephalic [long-skulled] a skull or such well-marked supra-orbital development. Would you have any objection to my running my finger along your parietal fissure? A cast of your skull sir, until the original is available, would be an ornament to any anthropological museum. It is not my intention to be fulsome, but I confess that I covet your skull. (Doyle, 1901/1976, p. 194)

Sherlock Holmes himself deduced from a large-sized hat that its owner was of high intellect. One literary skeptic was Herman Melville; in Moby Dick, Melville offers a lengthy, mocking phrenological description of the great whale. John Quincy Adams wondered "how two phrenologists could look each other in the eye without laughing?" (Morse, 1997, p. 26). Today, phrenological descriptions persist in disparaging references to "pointy-headed intellectuals" and "thick-skulled athletes." Phrenological measurement procedures reached their apex in 1905 with the development by Harry Lavery, a hotel manager and creator of gadgets, of the Lavery electric phrenologist, which was said to measure bumps "electrically and with scientific precision."[3] Lavery's hopes that his device would revolutionize the field of vocational guidance were not fulfilled. It became a diversion set up in department stores and hotel lobbies to give a psychograph or reading of character (Risse, 1976).

Given its popularity, why did phrenology fall out of favor, and why do we now regard it as at best a pseudoscience such as astrology, palmistry, alchemy, and Mesmerism? The answers lie in its fundamental characteristics and assumptions. First, the selection of faculties was indiscriminate. Attempts to describe the complexities of human intelligence and personality in terms of a limited number of faculties or powers were doomed to fail. Second, the phrenologists' arguments were circular. Why was William Teller a thief and Mr. Gosse a philanthropist who gave away two fortunes? Because Teller had a bump in the acquisitiveness area and Gosse an indentation. How do we know

[3] One of these remarkable devices is on display at the Museum of Questionable Medical Devices in Mississippi (*People Magazine,* November 8, 1999, p. 123). A psycograph was acquired by the Archives of the History of American Psychology in 2002 (Ochsenhirt, 2002).

that area to be the seat of the acquisitiveness power? Because Teller had a bump and Gosse a hollow in that particular spot (Fowler, 1859, p. 93). Such an explanation echoes Moliere's physician who explained that opium produces sleep because it has a soporific tendency (Young, 1970, p. 22). Third, the exploitation of gullible people was unacceptable to serious students of brain function and personality, as it probably would have been to Gall himself. Phrenology made a great deal of money for some people but was never accepted as a valid psychometric method. Fourth, phrenology with its circular predictions and explanations could never be scientifically tested and proved false. In 1857, G. H. Lewes advised the phrenologists to "cease for the present their accumulation of corroborative instances, and direct all efforts to the accumulation of *contradictory* instances" (Lewes, 1857, p. 674). Even when such contradictory instances were found, the phrenologists explained them away rather than considering their validity in supporting or refuting their theories. When Spurzheim learned that Descartes's skull was much smaller than average in the forehead region, in which intellect supposedly resides, he merely stated that "perhaps Descartes was not so great a thinker as many thought him to be" (Lewes, 1857, pp. 671–672). On a visit to London in 1873, Mark Twain consulted the American phrenologist Lorenzo N. Fowler in his chambers on Fleet Street. Finding a cavity in Twain's "humor area," Fowler concluded that Twain "was not as humorous as had been thought" (Morse, 1997, p. 26). Finally, many of the nineteenth-century's leading physiologists and anatomists, including Magendie, were severe critics of phrenology.

Magendie preserved with reverence the brain of French mathematician and physicist Pierre Laplace (1749–1827). Magendie invited Spurzheim to examine the brain, but, unknown to Spurzheim, substituted the brain of an imbecile for that of the great man. Spurzheim admired the brain of the imbecile as he would have that of Laplace (Flourens, 1864, p. 234). In his *Elementary Treatise on Human Physiology,* published in 1816, Magendie dismissed phrenology as a pseudo-science like necromancy.[4]

Finally, criticism by the nineteenth century's leading investigator of brain function, Pierre Flourens, proved devastating. In *An Examination of Phrenology,* published in 1843, Flourens presented a logical critique of phrenology and cited his own experimental studies of the effects of the removal of brain tissue (ablation) on the behavior of animals. Thickness of the skull varies from place to place, and the contours of the skull do not correspond to the contours of the brain; thus the fundamental assumption of phrenology is wrong. The phrenologists had located amativeness in the area of the brain that corresponds to the cerebellum. In his ablation experiments, Flourens found that damage to the cerebellum interferes with motor movements but does not interfere with the strength of an animal's sex drive.

Flourens's criticisms of phrenology were stringent, but it is important to understand any positive contributions phrenology might have made to the development of psychology. Phrenology reinforced both the belief that the brain is the organ of the mind and the suggestion that mental functions can be localized in the brain. Phrenologists contended that psychological characteristics

[4] *necromancy* n. The alleged art of divination through communication with the dead (RHDEL, p. 955).

are measurable, and since they used elaborate rating scales to record and score a particular individual's different powers, they reinforced the concept of individual differences—the domain that later became the focus of differential psychologists and personality theorists. Erna Lesky, the editor of an anthology of Gall's writings, claimed in 1979 that Gall was the father of the behavioral sciences, a great instigator of social reform, a criminal anthropologist of Cesare Lombroso's stature, and a precursor of Charles Darwin. These claims might be challenged, but it must be admitted that phrenologists had occasional successes. According to one report, a modern phrenologist examined Ray Kroc when he was 4 years old and predicted that he would have a successful career in the food industry (Kroc, 1987, p. 42). Kroc later founded McDonald's and amassed a fortune of $450 million selling food. McDonald's now has 23,000 fast-food outlets in 100 countries.

LOCALIZATION OF FUNCTION IN THE BRAIN

Studies of the Animal Brain

Marie-Jean Pierre Flourens (1794–1867) was the most important investigator of the functions of the brain during the middle decades of the nineteenth century. Flourens was an eminent French surgeon, the permanent secretary of the French Academy of Science, a grand officer of the Legion of Honor, a national deputy, and a professor at the College of France. A man of many honors and accomplishments, he devoted his life to investigating empirically the functions of the different structures of the brain. To Flourens, the brain appeared harmonious, intricate, and beautiful. Even to an untrained eye, the brain is clearly not a homogeneous mass, but rather a collection of many different parts, all obviously interconnected yet clearly different. Given that the brain has so many different structures, the question arises: Do they perform different functions? That was exactly the question Gall asked, but Flourens's search for an answer took a very different path.

In 1812, Jean Cesar Legallis made the first reliable localization of function in a brain structure when he identified a region of the medulla essential for respiration (Finger, 1994a). Flourens was a brilliant and precise surgeon noted for the elegance of his experimental procedures and tests. One method he used was ablation, an experimental procedure in which specific areas of the brain are removed surgically. Flourens hoped to use this method to determine the functions of the different structures of the brain. In his experiments, he followed two guiding principles. First, he believed that the parts of the brain to be studied should be anatomically separate and distinct. For Flourens, six units of the central nervous system were appropriate for study: the cerebral hemispheres, the cerebellum, the corpora quadrigemina, the medulla oblongata, the spinal cord, and the nerves themselves. Second, Flourens's approach was to study an animal's behavior, perform a delicate surgical operation in which one of the units was removed, allow the animal time to recover from the operation, and then study its behavior again. His experimental methods allowed much greater control and precision than "nature's experiments," in which brain damage occurred as the result of an accident, injury, or stroke. Flourens recognized that experimental and clinical approaches complement each other, but his approach was direct, surgical, and experimental. It still stands as a model for contemporary investigators of brain function.

Flourens summarized the results of his investigations in a paper published in 1823. The following year, he published a more extended report of his *Experimental Research on the Properties and Functions of the Nervous System in Vertebrates.* A second edition was published in Paris in 1842. Flourens drew several conclusions about the functions of the basic units of the brain. First, the cerebral lobes were the seat of all voluntary actions. Following removal of the cerebral lobes, an animal would exhibit only reflex responses—for example, the pupils of the eyes would dilate in the presence of a dim light and constrict in the presence of a bright light—but despite such reflexes, the animal would be functionally blind. It would not respond to visual stimuli. Auditory stimuli were similarly ineffective. Following removal of the cerebral lobes, a pigeon would remain motionless when a hooter sounded; before the operation, the hooter produced immediate flight. Also following surgery, the bird would eat only when food was pushed into its beak; it would not search for food. It would fly when thrown into the air; when left alone, it would not.

Flourens gave the following account of the behavior of a pigeon without its cerebral lobes:

> It held itself upright very well; it flew when it was thrown into the air, it walked when it was pushed; the iris of its eye was very mobile but nevertheless it did not see; it did not hear, it never moved spontaneously, it nearly always assumed the appearance of a sleeping or drowsy animal. . . . When I left it to itself, it remained calm and absorbed; in no case did it give any sign of volition. In a word, it was an animal condemned to perpetual sleep and deprived even of the faculty of dreaming during this sleep; such, almost precisely, had become the pigeon of which I had removed the cerebral lobes. (Flourens, 1823/1965, also in Clarke & O'Malley, 1968, pp. 484–485)

Given such results, Flourens concluded that the cerebral lobes are the seat of perception—we see and hear in our brains—and also the province of such higher mental functions as memory, will, and judgment. He summarized his results as follows:

> If the cerebral lobes are removed, vision is lost, for the animal no longer sees; volition is lost, for it no longer wishes to move; memory, for it no longer remembers; judgment, for it no longer judges; it strikes itself twenty times against the same object without learning to avoid it; it stamps on the ground when struck blows, rather than fleeing. (Flourens, 1823/1965, p. 363; also in Clarke & O'Malley, 1968, p. 485)

Following removal of the cerebellum, an animal walked only with jerky, spastic, uncoordinated movements. Birds with cerebellar damage appeared to attempt to fly, in contrast to birds with damage to their cerebral lobes, which appeared to have no such volition. But when birds with cerebellar damage were thrown in the air, they could not coordinate the movements necessary to stay aloft. Flourens found similar motor results when he progressively injured the cerebellum of a dog. As Flourens ablated deeper and deeper sections of its cerebellum, the dog's ability to walk disintegrated proportionately until it could no longer regulate its movements at all. Flourens correctly concluded from such systematic studies that the cerebellum controls and coordinates the motor activities involved in walking, jumping, flying, and standing.

Flourens found that animals can survive damage to the cerebral lobes and the cerebellum, but not damage to the structure containing areas that control the heart, respiration, and other systems that are "vital," or basic for life. Consequently, he called this area—the medulla oblongata—the "vital knot."

Thus far we have considered Flourens's descriptions of the functions of the brain's different areas or units, what he termed their *actions propres,* or specific actions. Flourens, however, also stressed that the brain is an interconnected, integrated system that functions with an *action commune,* or common action. He wrote:

> The nervous system is not a homogeneous system; the cerebral lobes do not act in the same way as the cerebellum, nor the cerebellum like the spinal cord, nor the cord absolutely like the nerves. But it is a single system, all of its parts concur, consent, and are in accord; what distinguishes them is the appropriate and determined manner of acting: what unites them is a reciprocal action through their common energy. (Flourens, 1823, p. 368; also in Clarke & O'Malley, 1968, p. 485)

The unity of the brain was for Flourens the reigning "grand principle." With such views, Flourens anticipated the *equipotentiality* and *mass action* concepts of a great twentieth-century student of brain function, Karl Lashley (Lashley, 1929). Flourens also studied recovery of function after brain injury. He found that small areas of the brain could endure damage without an obvious loss of function. The effects of an ablation depend on the amount of tissue removed. Some functions that the brain lost immediately after suffering damage it could, with time, recover. Flourens believed this recovery resulted when certain areas of the brain took over the functions of the ablated areas. This sort of recovery of function may be seen in stroke victims. Immediately after the stroke, the victims may be functionally devastated, but after some months many of them recover their abilities to some extent. These are human clinical analogues of the results Flourens reported.

Studies of the Human Brain

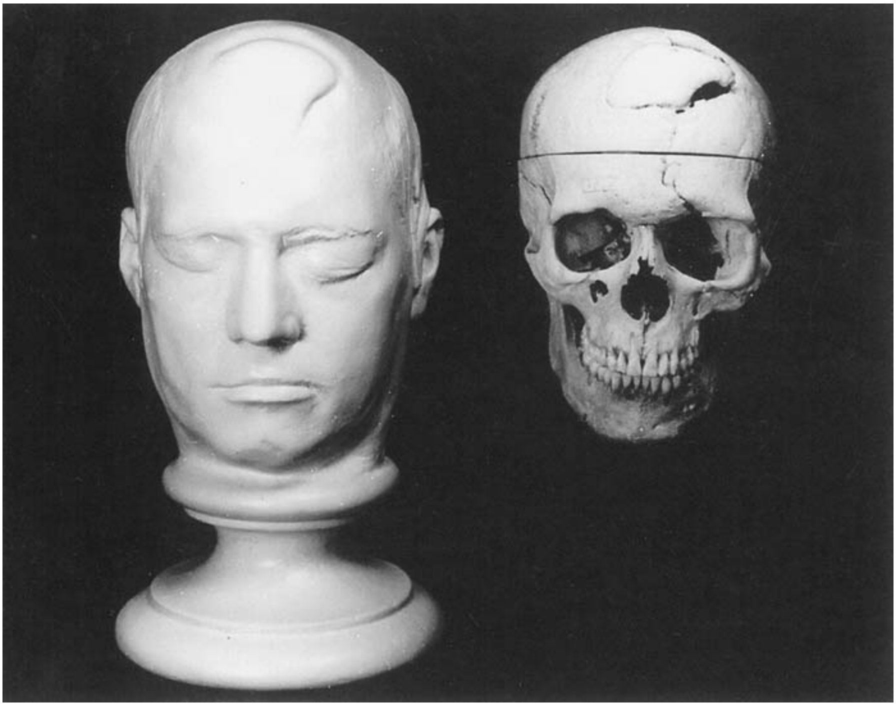
Above all else, Flourens believed that elegantly controlled, carefully conducted experiments are essential for an understanding of brain function. From his experiments with animals, he concluded that the brain is the organ of the mind. However, the question still remained: what of humans? Do the same principles apply to the human brain? In an ironic twist of history, Flourens's conclusion was shown to be applicable to humans by the terrible consequences of an accident involving a member of a railroad construction gang. A less controlled setting for the study of brain function would be difficult to imagine, yet the conclusion was the same.

The railroad accident occurred at 4:30 in the afternoon of September 13, 1848, near the small town of Cavendish, Vermont (Macmillan, 1986). The central figure was a 25-year-old railroad gang foreman, Phineas P. Gage, a man described by his fellow workers as shrewd, hardworking, pleasant, persistent, and energetic. He and his men were building a new railway line and were about to blast some rock. Alfred Nobel was not to invent dynamite until almost two decades later, in 1866. In Gage's time, the crews used gunpowder to blast the rock, a very dangerous procedure. Gage poured gunpowder into a hole drilled in the rock and tamped down the powder and fuse with a long iron tamping rod. Distracted by an argument between two of his men, Gage looked away. The tamping iron hit the rock, struck a spark, and ignited the powder. The 13-pound, 3-foot-7-inch tamping iron blasted from the hole, striking Gage just below the left eye. The iron exploded through his skull and rose high into the air, finally landing fifty yards away. Gage was thrown to the ground in a convulsion, but within a few minutes he regained consciousness and was able to speak. He was taken by ox cart to Cavendish. Gage got down from the cart by himself and sat on the veranda of the tavern where he lodged, awaiting the arrival of a doctor. He explained to bystanders what had happened and, when the doctor arrived, greeted him with the words "Doctor, here is business enough for you" (Macmillan, 1986, p. 74). The two local doctors who examined Gage found it difficult to believe his story, yet there was no doubt the terrible missile had indeed passed through his head. There were numerous eyewitnesses, the entry and exit wounds were obvious, and the tamping iron, covered with brain matter and blood, had been found. Slowly Gage recovered from his physical injuries, and by November he was out of bed and able to wander around the town. He was eager to return to work, but, tragically, was never able to do so. John Harlow, one of the two doctors who attended him after the accident, was a follower of the phrenologist Gall, and he understandably found Gage fascinating. His treatment was skillful and caring, and he kept detailed case notes. Harlow described Gage's difficulties as follows:

> His physical health is good and I am inclined to say that he has recovered. . . . The equilibrium or balance, so to speak, between his intellectual faculties and animal propensities seems to have been destroyed. He is fitful, irreverent, indulging at times in the grossest profanity, which was not previously his custom, manifesting but little deference for his fellows, impatient of restraint or advice when it conflicts with his desires, at times pertinaciously obstinate, yet capricious and vacillating, devising many plans of future operation which are no sooner arranged than they are abandoned in turn for others appearing more feasible. In this regard his mind was radically changed, so decidedly that his friends and acquaintances said he was "no longer Gage." (Harlow, 1869, pp. 13–14)

The injury to Gage's brain had radically changed his mind.

Phineas Gage was unable to find a job. His old employer fired him because of his erratic behavior, and he was forced to exhibit himself and the tamping



Gage's skull and death mask reveal the extent of his wound.
(Warren Anatomical Museum, Harvard Medical School)

iron at Barnum's Museum in New York City. In 1852, he left New England for employment in Valparaiso, Chile, caring for horses and driving six-horse coaches. In 1860, his health began to fail, and he returned to the United States. After a series of increasingly severe convulsions, Gage died on May 21, 1860 (Macmillan, 1986, p. 76). His skull and the tamping iron are still on display in the Museum of the Harvard Medical School. Using advanced three-dimensional computer imaging technology, Antonio and Hanna Damasio have constructed an image of Gage's brain, including the track of the tamping iron through the medial and ventral frontal lobes (Blakeslee, 1994). A recent book, *An Odd Kind of Fame: Stories of Phineas Gage* (Macmillan, 2000b), gives a vivid description of Gage's accident and its consequences, not only for him but for our understanding of the brain.[5] A Phineas Gage Commemorative Plaque was unveiled in Cavendish, Vermont, on September 13, 1998, the 150th anniversary of his accident.

The behavioral and personality changes Gage showed after his accident are characteristic of people with frontal lobe damage; such people are often highly distractable, lacking in foresight, frivolous, and unreliable in their conduct. John Harlow's description of Gage stands as a classic outline of the consequences of frontal lobe injury. Understandably, Harlow's report of the case

[5] Macmillan maintains an informative Phineas Gage website as well.

Language, the Preeminent Trait

Human language is perhaps the most important of human faculties and possibly the most complex activity that psychologists study. Consider the following characteristics of language:

- Language is universal. All known human cultures and societies have language.
- There are estimated to be between 6,000 and 6,700 languages spoken today.
- Some 6,000 languages have been described, 2,400 of which are no longer spoken.
- Only about 600 of the world's languages are relatively safe as they have a minimum of 100,000 speakers.
- Between 3,600 and 5,400 languages are facing extinction in the coming century.
- Most children don't use language until the second year of life. By the age of 3, they are sophisticated language users
- Complexity of sentence structure and syntax (grammar) emerge in the preschool years.
- Language causes precise new combinations of ideas to arise in our minds.

From Pinker, S. (1994). *The language instinct.* New York: William Morrow; and *Saving Alaska's native languages,* National Public Radio Morning Edition, March 8, 2002.

was often cited in the great debate over the cerebral localization of function. Part of Gage's brain had been destroyed, and his personality, emotions, and behavior changed beyond recognition. With such a case report and Flourens's experimental studies, the role of the brain as the organ of the mind had been established beyond dispute.

The Localization of Speech

One manifestation of human language is articulate speech. The question of the role the brain plays in the production and comprehension of speech was to be answered in the nineteenth century. Paradoxically, the answers came from the careful study of patients who had tragically *lost* the power of speech. For example, Jonathan Swift, the author of *Gulliver's Travels,* suffered a stroke and was unable to speak for a year before he died. He appeared to understand what was said to him and would sometimes utter emotional outbursts—once exclaiming to himself, "I am a fool!" (Fancher, 1990, p. 85).

Gall had seen cases of sudden loss of the capacity to speak. He attributed the loss of speech to injury to the organ of verbal memory, localizing that organ in the brain regions just behind the eyes. In this case, his localization, based upon clinical observation, proved to be correct. A soldier Gall saw had suffered a sword wound to the brain behind his left eye (Head, 1926, p. 9). The soldier could not recall the names of familiar things or of his acquaintances, referring instead to one of them as "Mr. Such-a-one." Gall's student Jean Baptiste Bouillaud (1796–1881), a founding member of the Phrenological Society of Paris, was one of a group of *new* phrenologists who came to reject most of the *old* phrenology. But cases such as the soldier's convinced Bouillaud that the brain does have a special, distinct, and independent language center. In 1848, in the midst of a heated debate on this issue, Bouillaud promised 500 francs to anyone who could produce someone who had a severe lesion of the frontal lobes *without* a speech disturbance.

No one met Bouillaud's challenge, and the issue lay dormant until the early months of 1861, when the question of the cerebral localization of speech was hotly debated at a series of meetings of the French Anthropological Society in Paris. At the February meeting, the surgeon and neurologist Pierre-Paul Broca (1824–1880), true to Flourens, stressed the action of the brain as a whole and criticized attempts to localize such functions as speech. His opponent in the debate was Ernest Auburtin (1825–1893), a 36-year-old surgeon and Bouillaud's pupil and son-in-law. In the climactic debate held on April 4, 1861, Auburtin described a case of sudden speech loss and challenged those who opposed his and Bouillaud's views on cerebral localization:

> For a long time during my service with M. Bouillaud I studied a patient named Bache, who had lost his speech but understood everything said to him and replied with signs in a very intelligent manner to all questions put to him. This man, who spent several years at the Bicêtre, is now at the Hospital for Incurables. I saw him again recently, and his disease has progressed; slight paralysis has appeared, but his intelligence is still unimpaired, and speech is wholly abolished. Without doubt this man will soon die. Based on the symptoms that he presents, we have diagnosed a softening of the anterior lobes. If, at autopsy, these lobes are found to be intact, I shall renounce the idea that I have expounded to you. (Auburtin, 1861, in Clarke & O'Malley, 1968, p. 493)

Bache did not resolve the issue, but within days of this challenge a man named Leborgne was transferred from the Bicêtre Hospital to a surgical unit headed by Broca. His symptoms were similar to Bache's. Twenty-one years earlier, he had lost his speech. He could understand what was said to him, could solve simple arithmetic problems by holding up the correct number of fingers, and could point out objects when asked. Like Swift, when he was angry he would utter an oath—*Sacre nom de Dieu* (sacred name of God)—but mostly his vocalizations were restricted to the sound "Tan." When questioned, he would reply, "Tan, tan." He was thus known by the name Tan throughout the hospital and has gone down in medical annals as Broca's patient "Tan." Broca examined his larynx and speech apparatus and found them normal. Tan did suffer from weakness on the right side of his body, a weakness which had developed into paralysis of his right arm and leg. His leg became gangrenous, and Broca saw his case as hopeless. Broca summoned Auburtin, who examined Tan and concluded he indeed met the criteria Auburtin had set forth in his challenge.

Tan died on April 17, 1861, and Broca performed an immediate autopsy. In the posterior part of the second and third frontal convolutions of the left frontal lobe, he found a cavity the size of a small egg filled with fluid. Auburtin had been correct. At that month's meeting of the Anthropological Society, Broca presented Tan's brain for inspection, pointing out that the lesion was restricted to the left frontal lobe. He also introduced the term *aphemie* (subsequently termed *expressive aphasia*) to describe Tan's loss of articulate speech. In a three-page report on Tan published in the *Anthropology Society's Bulletin*,

The embalmed brain of Broca's aphasic patient, Tan. The area of damage on the lower side of the left frontal lobe is now known as Broca's area.
(Courtesy of Musé Dupuytren)

Broca concluded, "All this permits, however, is the belief that in the present case, the lesion of the frontal lobe was the cause of the loss of speech (Broca, 1861, p. 238).

Next Broca saw an 84-year-old man named LeLong who had suddenly lost his speech. A postmortem examination of his brain also showed a lesion in the left frontal lobe, more circumscribed than the one in Tan's brain, but in the same area. The right hemisphere of his brain was perfectly normal. Head (1926) captures the sensational impact of Broca's reports:

> These communications produced the greatest excitement in the medical world of Paris. They were especially selected for comment by the Secretary of the Societe Anatomique, in his Annual Report for the year 1861. Bouillaud and his son-in-law, Auburtin, greeted Broca as a convert to their doctrines. Localization of speech became a political question; the older Conservative school, haunted by the bogeyman of phrenology, clung to the conception that the brain 'acted as a whole'; while the younger Liberals and Republicans passionately favored the view that different functions were exercised by the various portions of the cerebral hemispheres. During the next few years, every medical authority took one side or other in the discussion. (Head, 1926, p. 25)

In 1863, Broca described twenty-five aphemic patients, all with lesions of the left hemisphere. In 1865, he presented additional cases and concluded:

> I persist in thinking, until further details are available, that true aphemia, that is loss of speech without the paralysis of the organs of articulation and without the destruction of the intellect, is linked to lesions of the third left frontal convolution. (Broca, 1865, in Berker, Berker, & Smith, 1986, p. 1066)

Broca was puzzled that these patients showed no signs of damage to the right frontal lobe, suggesting that contrary to Bouillaud's original thesis, the center of speech is specific to the left frontal lobe. Broca had also observed deep lesions of the third right frontal convolutions in patients who were not in any way aphemic. That the two frontal lobes, with their identical situations, size, and symmetry, would have such different functions contradicted the law of organic duality and was for Broca a sublime puzzle. It remains so today.

Broca's findings radically changed the debate over the localization of function in the brain. In a review of nineteenth-century studies of aphasias, Marx (1966) reported over three thousand papers. In 1980, the French journal *Revue Neurologique* dedicated a special volume to Broca. His memory, and that of his patient Tan, will be forever honored in references to Broca's area of the brain.

Broca considered articulate language to be the highest human achievement. Having localized that function in the left frontal lobe, Broca went on to hypothesize that the left hemisphere develops more quickly than the right and so is more advanced, or the superior hemisphere (Harrington, 1987). Broca's hypothesis anticipated contemporary discussions of the articulate, intellectual left brain and the intuitive, mystical right brain, the seat of the "bicameral mind," where the prophetic and visionary language of the gods can be heard (Ornstein, 1972; Jaynes, 1976).

In 1874, Carl Wernicke (1848–1905), in his career-long study of cerebral localization, identified another type of aphasia. Wernicke's aphasia results from damage to the superior portion of the left temporal lobe; speech output can be rapid and effortless and has the rhythm and melody of normal speech, but it conveys little meaning. A Wernicke's aphasic might say: "Oh sure, go ahead, any old thing you want" or "If I could I would. Oh, I'm taking the wrong way to say, all of the barbers here whenever they stop you it's going around and around, if you know what I mean" (Restak, 1988, p. 213).

By 1874, scientists had described the role of the brain in the production and comprehension of language and had identified two different language disturbances associated with damage in two distinct areas of the left temporal lobe. Progress had indeed been made.

DIRECT STIMULATION OF THE BRAIN

So far, we have considered conclusions drawn from studies of the consequences of brain damage that followed accident or disease or that was produced experimentally. The nineteenth century also saw the development of a second important technique for the study of brain function: direct stimulation of the brain. The first attempts involved "agitation" of the brain surface. Around 1860, Franz von Leyden injected a solution of sodium chloride between the skull and the surface of the brain. Hans Pagenstecher conducted an extended series of studies, reported in 1871, in which he injected a mixture of white wax and tallow heated to 50 degrees Centigrade between the skull and brain in dogs. Following this injection, the animals showed derangement, loss of physical function, stupor, somnolence, and coma together with motor disorders, convulsions, and paralysis. In 1873, Fournie made a small opening in an animal's skull through which he injected various corrosive substances. Injections into the gray matter destroyed clusters of brain cells and were associated with loss of movement of distinct groups of muscles on the opposite side of the body.

However, true progress came not from these crude and often lethal procedures but from experiments in which the brain was stimulated electrically.

The first person to stimulate the brain electrically appears to have been L. N. Simonoff, who in 1860 published an account of an operation in which he implanted electrodes in an animal's brain stem. Following the operation, he delivered electrical current directly to the brain of the unanesthetized animal. However, the most important early demonstrations of the effects of direct electrical stimulation of the brain were those of Gustav Fritsch (1839–1927) and Edward Hitzig (1838–1907). Fritsch was a man of independent means whose only important scientific contribution was this research, and Hitzig was a skilled anatomist. While serving as an army physician toward the end of the 1860s, Hitzig applied a mechanical stimulus to the exposed surface of the brain of a wounded soldier. When different brain areas were stimulated, different muscular movements would occur. After the war, Hitzig collaborated with Fritsch in investigations using animals, first stimulating the brain of a rabbit and then conducting a systematic study of the effects of the electrical stimulation of a dog's brain. These famous experiments were done on a dressing table in the bedroom of Fritsch's small Berlin house because the University of Berlin had no space for their research (Haymaker, 1953, pp. 138–142). Fritsch and Hitzig placed wires or electrodes on the surface of the brain and applied current of different intensities. In anterior portions of the cerebral cortex, a weak current would elicit motor movements; a more intense current produced convulsive general movements. In 1870, Fritsch and Hitzig published a paper entitled "On the Electrical Excitability of the Cerebrum" describing their results. They concluded with admirable clarity:

> A part of the convexity of the hemisphere of the brain of the dog is motor . . . another part is not motor. The motor part, in general, is more in front, the nonmotor part more behind. By electrical stimulations of the motor part, one obtains combined muscular contractions of the opposite side of the body. (Fritsch & Hitzig, 1870/1965, p. 81)

Fritsch and Hitzig were able to localize brain areas controlling five different groups of muscles involved in extension of the neck, extension and flexion of the foreleg, movement of the hindleg, and movement of the face. Electrical stimulation of one side of the brain always caused movement on the opposite side of the body.

Laboratories in New York, Boston, and Italy quickly replicated these findings (Jefferson, 1960, p. 127). But the most important work was that of David Ferrier (1843–1928), first at the West Riding Lunatic Asylum in Yorkshire and later at the National Hospital for the Paralyzed and Epileptic in London. Ferrier was able to conduct a series of brilliant experiments, using both stimulation and ablation, to localize both sensory and motor functions. His aim was to create a "scientific phrenology." His first results were published in the West Riding Lunatic Asylum Medical Reports and then in more detail in his celebrated *The Functions of the Brain,* first published in 1876. Ferrier implanted brain electrodes in dogs, jackals, cats, rabbits, rats, guinea pigs, pigeons, frogs, and

In David Ferrier's Laboratory

Susan Leigh Star, in her book *Regions of the Mind: Brain Research and the Quest for Scientific Certainty* (1989), gives this vivid, composite description of research in David Ferrier's London laboratory:

Ferrier's worries were many: the monkeys were expensive, his budget was limited; he could not afford to be away from patients for long; and the antivivisectionist movement was growing stronger and more politically powerful. If he could only get positive results before they moved to close down his laboratory! His practice was growing as a result of fame from his experiments, yet he got no release time or pay to do physiological research, still considered a sort of hobby in English medical circles.

It had been a long week. Yesterday's experimental subject, a large female macaque, had been most recalcitrant. She had run away from Ferrier, snarled, and knocked the electrodes from his hands when he had tried to apply the galvanic current to her brain to test her muscle movements.

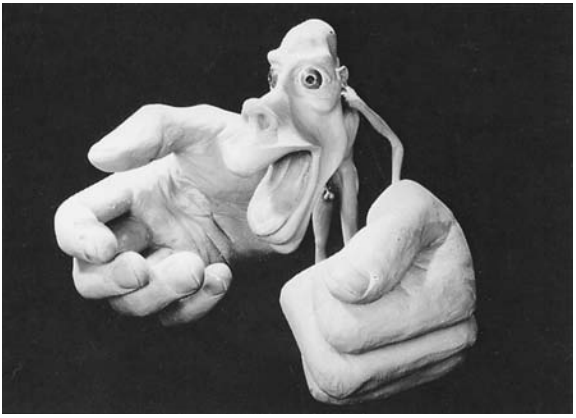
Even when experiments went smoothly, it was often hard to tell exactly which functions had been impaired by the surgical lesions or which parts of the brain were responding to current. Were the limbs twitching, or moving under the electrical stimulus? Was the paralysis from impairment of an area of the brain, or was it shock from the operation itself? Ferrier often could not be sure.

Finally, the monkey began to come out of the anesthesia. Ferrier bandaged up the head wound from the operation, then sat down wearily and waited for the animal to come to consciousness. He lit a gas burner at one end of the room and made a pot of strong tea.

Several hours later, the monkey irritably clung to the hot water pipes, the only source of heat in the cold basement laboratory. Ferrier gave the animal a saucer of tea and noted that she was able to drink it. Like the night attendant in a hospital he tried to jot down an accurate record of the symptoms exhibited by his subject, including twitches and epileptic seizures. At night's end, Ferrier and the monkey stared at one another across the laboratory, drinking their respective cups of tea. (Star, 1989, pp. xi–xii)

fish. First Ferrier stimulated the frontal lobes and was puzzled when the stimulation produced little response. But he was able to localize motor and sensory functions in the animals' brains. In the monkey, Ferrier localized fifteen different motor functions, including advance of the opposite leg, retraction of the opposite arm, opening of the mouth and protrusion of the tongue, opening of the eyes, and pricking up the ears. His results were acclaimed as marking the beginning of a new era in brain function knowledge. Ferrier himself claimed to have removed the "doubt and discrepancy" of the past (Ferrier, 1886, p. 222). In 1876, Ferrier was elected a Fellow of the Royal Society and awarded a grant to continue his research. So precise were his results that he was able to transfer his monkey localization map directly to the human brain and localize the first brain tumor to be removed in a neurosurgical operation (Bennett & Godlee, 1885).

Later it was found that representation of the different body parts in the motor cortex is proportional to their function rather than to their body mass. For example, the hands are much more heavily represented than is the back. Such relationships are often shown in physiological texts through drawings of the *motor homunculus*, a humanlike cartoon figure drawn in proportion to the



A sensory homunculus, showing the body as it is represented in the brain's sensory projection areas.
(The British Museum of Natural History)

cortical representation of different functions. Such figures have a rather alarming appearance, with their enormous lips and tongues, large hands, and small backs. They show a cortical representation of the body, not the body we are used to seeing.

What of sensory functions? Ferrier localized vision in the occipital cortex, since stimulation of the occipital region produces movements of the eyeballs and contraction of the pupils. Animals with one occipital lobe ablated are blind in the eye opposite the ablation. Audition was localized in the temporal lobe; Ferrier found that a monkey with a left temporal lobe ablation appeared unconcerned when a percussive cap was fired. The animal was undoubtedly deaf. By the end of the nineteenth century, the somesthetic senses (senses such as touch and pressure related to the muscles and internal organs) had also been localized in the postcentral region, posterior to the motor centers.

Further progress came from the contributions of Ferrier's compatriot and sometime-collaborator, John Hughlings-Jackson (1835–1911). Hughlings-Jackson was largely self-taught, an intensely shy, aloof, modest, carefully controlled man (Clarke, 1973, p. 46). His wife was afflicted with what is now known as Jacksonian epilepsy, in which the seizure starts in one part of the body, such as a hand, and then spreads through the wrist, arm, elbow, shoulder, and neck to the face. Hughlings-Jackson described the seizure as "marching" in an orderly, predictable path through the internal geography of the brain. He also developed a conceptual model of the organization of the brain. Perhaps influenced by the political views of Thomas Hobbes (Chapter 2) and the rigidly hierarchical nature of British society in his time (Star, 1989), Hughlings-Jackson compared the brain to a government that can only endure by suppressing lower, less legitimate sources of power and authority. In the human brain, the higher cortical centers rule by controlling or inhibiting the lower, older, and more primitive centers. Inhibition, Hughlings-Jackson believed, is the mark of a healthy brain, just as what we do *not* do as a society is the mark of civilization.

When such higher inhibitory control is removed, the result is behavioral, emotional, and intellectual anarchy such as Phineas Gage experienced. This hierarchical model of cerebral organization is still influential today.

Electrical Stimulation of the Human Brain

Less than five years after the first animal experiments using electrical stimulation of the brain, a similar experiment was performed on a human patient. The time lag seems amazingly short. Dr. Roberts Bartholow, a professor of clinical medicine at the Medical College of Ohio in Cincinnati, observed the effects of electrical stimulation of the human brain. In April 1874 he published a report of his "Experimental Investigations into the Functions of the Human Brain" in the *American Journal of the Medical Sciences.* Bartholow was aware of the earlier animal experiments of Fritsch and Hitzig and of Ferrier and cited their results in the introduction to his report. However, he also stressed that similar investigations should be made of the human brain.

Taking advantage of what he termed "a clinical opportunity," Bartholow conducted just such an investigation. His patient's name was Mary Rafferty. From the case notes of the house physician, Dr. Steeley, we learn that Rafferty was a 30-year-old domestic worker born in Ireland but later a resident of Cincinnati. She was admitted to Cincinnati's Good Samaritan Hospital in January 1874. Rafferty was not well-nourished and appeared somewhat feebleminded. She had been in good health until thirteen months earlier, when a small ulcer had appeared on her scalp. Rafferty believed that the ulcer was produced by friction caused by a piece of whalebone in her wig. Upon admission, her skull was found to be completely eroded over a circular area two inches in diameter. Through this hole the pulsations of her brain were visible.

Rafferty was able to answer questions correctly and converse in a bright and cheerful manner. Bartholow inserted needles through the hole in her skull into the brain. The needles were insulated except for their tips so that electrical currents could be delivered to localized areas of her brain. The first observations Bartholow made followed penetration of the dura mater (the tough membrane covering the brain) and stimulation of the brain itself. He described the results as follows:

> Needles were inserted at various points into the *dura mater* and into the brain. When the irritable granulations of the surface of the ulcer were touched, pain was experienced; but when the needle points were engaged in the *dura mater,* Mary declared, in answer to repeated questions, that she felt no pain and certainly did not indicate any by her conduct. No pain whatever was experienced in the brain-substance proper. (Bartholow, 1874, p. 310)

In Bartholow's second and third sets of observations, he inserted needles deep in his patient's *dura mater* and posterior lobes. When stimulated in the left posterior lobe, Rafferty reacted with muscular contractions of the right arm and leg, her neck muscles moved, and her head turned to the right. When she was stimulated in the right posterior lobe, her head deflected to the left and her left arm and leg extended. During the brain stimulation, Rafferty complained of a very strong and unpleasant tingling in her arms and legs and at one point seized her hand with the opposite hand and rubbed it vigorously. Despite this, Bartholow reported that she remained cheerful throughout the observations. Rashly, Bartholow decided to increase the strength of the electrical stimulation in order to produce more intense reactions. He described the tragic result:

> In order to develop more decided reactions, the strength of the current was increased. . . . When communication was made with the needles, her countenance exhibited great distress, then she began to cry. Very soon the left hand was extended as if in the act of taking hold of some object in front of her; the arm presently was agitated with clonic spasms; her eyes became fixed, with pupils dilated, lips were blue, and she frothed at the mouth; her breathing became stentorous; she lost consciousness and was violently convulsed on her left side. The convulsion lasted five minutes and was succeeded by coma. She returned to consciousness and complained of some weakness and vertigo. (Bartholow, 1874, pp. 310–311)

While Bartholow's ingenuity and boldness in carrying out this exploration and his honesty in reporting its results may be admired, his ethics are certainly open to question. The consequences were disastrous for Mary Rafferty. Three days later, she was still pale and depressed. Bartholow planned further brain stimulation sessions, but her condition deteriorated rapidly, and he was forced to abandon his plan. She had difficulty walking and complained of numbness and tingling on the right side of her body and frequent dizzy spells. Four days after the initial observations, she became incoherent, had a convulsive seizure followed by paralysis of the right side of her body, then lapsed into unconsciousness and died. Bartholow performed an autopsy and examined her brain. Tracks made by the electrodes were clearly visible, penetrating the brain to a depth of 1 inch in the left parietal lobe and 1½ inches in the right posterior frontal lobe. The surrounding brain tissue was unaffected. Bartholow published his findings in April 1874, ending his account with the statement "It has seemed to be most desirable to present the facts as I observed them, without comment" (Bartholow, 1874, p. 313).

Unfortunately for Bartholow, his report led to many "comments" by others; in fact, it created a scandal. His procedures struck many observers as intolerable, raising in their minds the specter of the "mad scientist" creating human robots by direct stimulation of the brain. The public outcry forced Bartholow to resign his academic position at the university and his staff position at the hospital. In fact, so intense and critical was the reaction that he was forced to leave Cincinnati.

Bartholow's observations were the beginning of what David Krech has described as the era of the "surgeon-experimenter." Krech wrote:

> With these discoveries the great era of the surgeon-experimenter was to begin. From now on, every human brain exposed for medical treatment was an open invitation to experiment. And many of these invitations were accepted. (Krech, 1962, p. 63)

The key phrase here is "exposed for medical treatment." Rafferty's brain was not exposed for treatment, whereas in modern procedures exposure of the brain is part of the treatment. Such procedures depend on maps or atlases

How the Brain Processes Information: Golgi vs. Cajal and a Modern Synthesis

In the late nineteenth and early twentieth centuries, Camillo Golgi (1843–1926) and Ramón y Cajal (1852–1934) sought to identify the basic structural units of the brain and determine how they connect and interact. Golgi was a professor of histology and pathology at the University of Pavia in Italy. In the 1870s, Golgi, like many others, was trying to outline the brain's structural units by exposing blocks of neural tissue to various chemicals. Quite by accident, he discovered a combination of chemicals that worked. When neural tissue hardened with potassium bichromate was immersed in a 0.5 to 1 percent solution of silver nitrate, *some* of the cells—about 10 percent—would absorb the silver nitrate and turn black, making their outlines visible. The serendipitous discovery of this "black reaction" made it possible to see for the first time individual neurons with their cell bodies, dendrites, and axons. Since his stain marked only some of the neurons, Golgi concluded that the neurons as a whole form a thickly interlaced network, or reticulum. According to Golgi's reticular doctrine, nerve impulses are propagated in a continuous process through reticles or networks of interlaced of cells.

Golgi's reticular doctrine was vigorously opposed by Cajal, a Spanish histologist. In an attic room laboratory, using a $25 microscope and a box of slides, Cajal investigated how the nerve impulse is conducted through the brain (Cajal, 1901). Ironically, his challenge was based on the use of Golgi's stain. Cajal applied the potassiumn bichromate/silver nitrate technique to embryonic rather than adult neural tissue. He showed that axons end in terminals which are in close contact with the dendrites and cell bodies of other neurons, *but which do not touch.* There is a gap or synapse between neurons, and the nerve impulse must bridge this gap. Cajal's neuron doctrine asserts that the brain's neurons are separate and distinct units. He would work on his stains all day and then at night make India ink drawings and watercolors to complement his reports. Cajal's lyrical descriptions of the neuron show his feelings of awe and wonder:

specifying the three-dimensional coordinates of a brain structure, and thus its location, and stereotaxic instruments that allow the surgeon to place electrodes within targeted structures in the brain. The first stereotaxic instrument for the human brain was designed by Aubrey Mussen around 1918 (Olivier, Bertrand, & Picard, 1983). It is now housed at the Montreal Neurological Institute—an appropriate location, for it was in Montreal that Wilder Penfield and his colleagues, beginning in 1928, performed over four hundred operations on patients suffering from some form of epilepsy and needing brain surgery. During the operations, the brains of some of these patients were stimulated with what Penfield termed "gentle electrical currents." Motor responses following the stimulation could be observed, and since the operations were performed under local anesthesia, Penfield could ask the patients for verbal reports of their experiences. In their classic book *The Cerebral Cortex of Man,* originally published in 1950, Penfield and Rasmussen described sensory and motor areas along

How the Brain Processes Information:
Golgi vs. Cajal and a Modern Synthesis (Continued)

The aristocrat among the structures of the body, with its giant arms stretched out like the tentacles of an octopus to the provinces on the frontier of the outside world, to watch for the constant ambushes of physical and chemical forces. (Cajal, in Restak, 1984, p. 26)

Cajal gave the Croonian Lecture to the Royal Society for 1894. The great British neurophysiologist Sir Charles Sherrington (1857–1952) was his host. Sherrington's wife was to discover that Spaniards stripped their beds each day and hung the bedding out of the window to air. That worked well in Spain, but in the wet English climate was less successful and also the cause of much consternation among the neighbors. Mrs. Sherrington also found that Cajal kept his bedroom door locked all day. He was protecting the little laboratory he had set up to give the final touches to the nervous tissue stains he would present during his lecture. Cajal enjoyed his time in England. "The grey matter," he said, "goes well under grey skies" (Eccles & Gibson, 1979, pp. 6 and 10).

In 1906, Golgi and Cajal shared the Nobel Prize for physiology and medicine, with the selection committee unable to choose between their reticular and neuron theories. Golgi's acceptance speech was a harangue against Cajal and the neuron theory spiced with barbs and attacks on Spain and Spanish culture. Cajal had immense pride in the science and culture of Spain (Taylor, 1975, pp. 273–274), so Golgi's words must have hurt. He did have the consolation of seeing his neuron doctrine prevail, and until recently Golgi has often been described as having been in error, while Cajal was correct. Recent research, however, has shown that in addition to the synaptic transmission Cajal proposed, the brain uses volume transmission. The medium of communication is the fluid-filled space between brain cells, and the neural messages are chemical and electrical signals that travel through that space and are detected by cells with the appropriate receptor (Agnati, Bjelke, & Fuxe, 1992).

either side of the fissure of Rolando, an area in which speech is localized, and areas in the temporal lobe in which the brain apparently stores memories, hallucinations, illusions, and even dreams. Brain stimulation had indeed proved to be a powerful technique for unraveling the mysteries of the human brain.

Brain Stimulation Reinforcement

There has been a large body of research using electrical brain stimulation. One of the most intriguing findings in this body of research is that stimulation of certain brain areas is highly rewarding or reinforcing. In 1924, two French investigators, Michel Victor Pachon and Valentin Delmas-Marsalet, found a cortical area for reward. They implanted copper electrodes unilaterally in a subcortical region of the cerebral hemispheres, the caudate nuclei in two dogs (Kenyon, 1981). Electrical stimulation of the brain through these electrodes would rouse the sleeping dogs; they would lick their lips with "evident satisfaction" and begin to chew. With prolonged stimulation, the dogs would get up and walk. The researchers concluded that the caudate nucleus plays a role in the expression of affective states and in certain automatic movements. Thirty years later, in 1954, James Olds and Peter Milner reported that rats would lever-press at very high rates for intracranial stimulation and would continue to do so until exhausted (Olds & Milner, 1954).

PROGRESS AND CHALLENGE

Obviously, great progress has been made in the study of brain function. Looking back on the decades around the beginning of the twentieth century, it is not difficult to understand the excitement and optimism investigators felt at that time. Two techniques for studying brain function—ablation and stimulation—had been developed and produced lots of new knowledge. Sherrington dedicated his great 1906 work, *The Integrative Action of the Nervous System,* to David Ferrier, expressing his admiration but also his astonishment that such imperfect procedures could produce such precise results. Even the brain mechanisms underlying the formation of associations seemed on the point of revelation. For instance, in 1905, Baer implanted electrodes in the visual and motor cortexes of dogs. He then paired stimulation of the visual cortex with stimulation of the motor cortex and found that after a number of pairings, stimulation of the visual cortex alone would elicit the motor movements previously elicited by stimulation of the motor cortex. An association had been established within the brain, but it was a controlled association based on the electrical stimulation of discrete areas. Perhaps the very cortical basis of learning and memory could be discovered.

The more optimistic investigators surely must have thought that if only they could conduct a sufficient number of careful experiments using ablation and stimulation, the mysteries of brain function might be solved. It seemed only a matter of time. However, such hopes were premature. One of the most eminent twentieth-century investigators of brain function, Karl Lashley (1890–1958), concluded in 1950 that attempts to localize such psychological capacities and functions as learning, memory, and intelligence were based on oversimplified conceptions of brain function and should be abandoned. Lashley spent over thirty years searching for engrams, the physical or chemical changes in the brain assumed to underlie memory. He tested thousands of rats, systematically studying their behavior and brains. In 1950, Lashley reviewed this prodigious effort in a paper entitled "In Search of the Engram." He concluded:

> I sometimes feel in reviewing the evidence of the localization of the memory trace, that the necessary conclusion is that learning just is not possible. It is difficult to conceive of a mechanism which can satisfy the conditions set for it. (Lashley, 1950, p. 477)

However, an important lesson can be drawn from Lashley's conclusion. Neuropsychological techniques may not be sufficient to gain an understanding of learning, memory, and other psychological processes. While great progress has been made in this field in recent years, there is still a need for behavioral assessment and evaluation, the province of psychology. While contemporary psychology is very different from the independent science Wilhelm Wundt first established late in the nineteenth century, it is to Wundt that we turn first for a consideration of psychology as an independent branch of science with its own subject matter and, most important, its own distinct methods of investigation.

Wilhelm Wundt.
(National Library of Medicine)

CHAPTER 4

Wilhelm Wundt and the Founding of Psychology

Only the most contentious of psychologists would dispute the assertion that psychology as an experimental science begins with Wilhelm Wundt's establishment of the world's first psychological research laboratory at the University of Leipzig in 1879. Who, then, was Wundt, and how did he come to establish that laboratory? A bearded, distinguished-looking Wilhelm Wundt gazes calmly through wire-rimmed glasses from his portrait opposite this page. Similar portraits appear in many psychology textbooks, with Wundt often identified as the "founder of psychology" or the "world's first true psychologist." So it is appropriate that Wundt is the first psychologist we will consider.

WILHELM WUNDT (1832–1920)

Wilhelm Maximilian Wundt was born August 16, 1832, in the small village of Neckarau near Mannheim in the German principality of Baden. He was the youngest of four children born to a Lutheran pastor. Wundt's father's family included historians, theologians, economists, geographers, and two presidents of the University of Heidelberg. His mother's side of the family was equally prominent, counting scientists, physicians, and government administrators among their members. Some scholars have concluded that no contemporary German family had as many intellectually active and productive individuals (Bringmann, Balance, & Evans, 1975, p. 288). It seems likely that such a distinguished family background would have provided the young Wundt with a stimulating environment, yet he appears to have had a lonely and, at times, unhappy childhood. His brother was eight years older and was away at school during Wundt's childhood, and two other siblings died in infancy. For many years Wundt's only playmate was a slightly older retarded boy who could hardly speak. The boy was endlessly good-natured, but Wundt was always responsible for him and seems never to have had a chance to learn how to play. Throughout his life, he remained a shy, reserved person who disliked meeting strangers, hated to travel, and avoided new experiences.

Wundt's maternal grandfather took a personal interest in his education, taking him on frequent trips and tours. Together they served as sidewalk supervisors during the construction of the area's first railroad station. However, Wundt's grandfather was a stern and authoritarian taskmaster who insisted on a rigorous daily schedule and absolute precision in everything they did. Between the ages of 8 and 12, Wundt received his formal education from his father's assistant, a young pastor who gave the boy the love and warmth neither of his parents could provide. When the young man moved to a church of his own, Wundt was so distressed that he was allowed to join the young man for a year. He continued his education at the local Catholic Gymnasium.

The German word *gymnasium* sometimes causes confusion. For the ancient Greeks, a gymnasium was a place where naked young men—women were excluded—prepared for and engaged in athletic competition. In English, the word has a similar meaning, except that both men and women, at least minimally clothed, engage in athletic activities. For most of German-speaking Europe, a gymnasium is a fee-charging secondary school for students 10 and over who meet high entrance standards. Gymnasiums follow a rigorous curriculum to prepare students for university studies. The teachers are highly qualified, often holding doctoral degrees, and they devote themselves entirely to teaching. The reputation of a gymnasium depends upon the performance of its students on competitive university entrance examinations (Macrae, 1992).

For most students, gymnasiums provide an excellent education, but not for Wundt. Due to his admitted "unbridled day-dreaming," Wundt failed his year at what he later referred to as his "school of suffering." So poor was his academic record that Wundt was advised to seek some honorable calling, such as the postal service, which did not require an education (Diamond, 1976, p. 526). Instead, the ecumenical Wundt transferred to the Lutheran Gymnasium at Heidelberg. There he was more successful, graduating in 1851.

When Wundt's father died in 1845, his mother was forced to support the family on a small clerical pension. The family had never been wealthy, but now financial pressures were severe. Wundt's less-than-stellar academic record precluded a university scholarship. He also was undecided as to a career. Fortunately, his mother's brother, a professor of brain anatomy and physiology at the University of Tübingen, encouraged Wundt to enter the university as a premedical student. Wundt stayed at Tübingen just one year before transferring to the University of Heidelberg. He had little money but worked very hard and completed the medical curriculum in three years rather than four, saving a year's fees and expenses. Wundt graduated *summa cum laude* in 1855 and placed first in the state medical board examination. For his medical dissertation research, Wundt studied the touch sensitivity of hysterical patients at the University of Heidelberg Hospital. He later described these experiments as the first steps toward his experimental work in psychology.

At Heidelberg, Wundt did research with the organic chemist Robert Wilhelm Bunsen (1811–1899). Bunsen had a distinguished and sometimes dangerous career. He lost an eye in a laboratory explosion and nearly died from inhaling arsenic vapors (Asimov, 1982, p. 375). He also developed a method for gas analysis that had important industrial applications. Bunsen showed that existing coal and charcoal furnaces were highly inefficient. He developed ways of recycling gases that made the furnaces more efficient and also reduced the volume of gases emitted. Towards the end of his career, Bunsen, with Gustav Kirchoff, did important research on spectroscopy.[1] Despite these contributions, Bunsen is best known for his 1855 invention of the well-known gas burner that bears his name. Bunsen and Wundt were interested in the effects of restricted salt intake on urine composition. Since they could not find a volunteer to eliminate all dietary salt, Wundt did the experiment on himself. He thus followed a long tradition of self-experimentation in medical research which continues to this day: John Scott Haldane (1860–1936) and his son John Burdon Sanderson Haldane (1892–1964), in their experiments on respiratory physiology, presented hundreds of risky and noxious challenges to their own respiratory systems. Others, in developing anesthetic agents, experimented on themselves with paralytic and potentially lethal agents. In 1986, the French immunologist Daniel Zagurny injected himself with a vaccine he hoped would counter AIDS (Altman, 1987).

Wundt's experiment turned out well, and he published a paper describing its results in the *Journal of Practical Chemistry* (1853). He had the highly reinforcing experience of seeing his paper cited in the literature. Wundt decided to pursue an academic and research career.

Wundt's Early Academic Career

In 1856, Wundt spent a semester at the University of Berlin, studying with Johannes Müller and Emil Du Bois-Reymond (Chapter 3). In 1857, Wundt returned to Heidelberg as a *Privatdozent* (lecturer) in the Department of Physiology. His first course offering was experimental physiology. Only four students took the course, which was a disappointment; in the German university system, a *Privatdozent* was dependent upon the students' fees for his income. Wundt taught the course in his mother's apartment, but it was a beginning. He worked very hard arranging demonstrations to complement and confirm his lectures. He was determined to succeed; but, overworked, he became seriously ill and was even for a time close to death. Later, Wundt recalled his experience of near death as being one of "perfect calm," without fear. After his illness, he took a leave of absence to recuperate in the Swiss Alps.

In 1858, Hermann von Helmholtz (Chapter 3) was appointed the head of the new Institute of Physiology at the University of Heidelberg. He in turn appointed Wundt as his assistant. Wundt was delighted to accept the position, for he considered Helmholtz the best scientist at Heidelberg and, along with Müller and Du Bois-Reymond, one of the three great German physiologists of the time. Wundt shared a room with I. M. Sechenov (1829–1909), a young Russian physiologist who later was to influence Ivan Pavlov (Chapter 12). Unfortunately, the position was something of a disappointment as Wundt was required

[1] *spectroscopy,* n. The science that deals with the use of the spectroscope and with spectrum analysis. *spectrum,* n. An array of entities, as light waves or particles, ordered in accordance with magnitude of a common physical property, as wavelength or mass (RHDEL, p. 1366).

to be more a teaching than a research assistant. The government had just passed a regulation requiring medical students to take a laboratory course in physiology, so Wundt's main duty was teaching the fundamentals of sensory physiology and laboratory procedures. However, he was able to develop a new course in anthropology, or what today would be called social psychology. Wundt offered the course, which addressed the relation of the individual to society, for the first time in 1859. He was to return to this interest in the last decades of his life and produce a ten-volume *magnum opus* (great work) on the topic (Schneider, 1990).

During his years as Helmholtz's assistant, Wundt also wrote his first book, the *Beiträge zur Theorie der Sinneswahrnehmung* (Contributions Toward a Theory of Sense Perception), published in 1862. In this book Wundt discussed sensory functions, developed a theory of perception, and, according to Edward Titchener (Chapter 5), outlined a program for psychology that he followed for the rest of his life. Wundt saw psychology as falling between the physical sciences (*Naturwissenschaften*) and the social sciences (*Geisteswissenschaften*). Experimental and research methods comparable to those used in the physical sciences were to be used to address psychological questions. Wundt saw this new science of psychology as having three main subdivisions. One branch would be an inductive, experimental science. Wundt had read and was impressed by the writings of John Stuart Mill (Chapter 2). But Mill's approach was that of a philosopher who speculates and thinks about mental life; Wundt's was that of a scientist who uses experimental methods to study mental life.

Wundt believed that language, myths, aesthetics, religion, and social customs are reflections of our highest mental processes and thus should be topics studied in a second subdivision of psychology. But since these processes could not be manipulated or controlled, they could not be studied experimentally. Instead, Wundt believed they could be investigated through historical records and literature and by means of naturalistic observations.

Wundt conceptualized a third branch of psychology that was to integrate the empirical findings of psychology and other sciences. Scientific metaphysics, as he labeled this subdivision, would develop eventually into what Wundt saw as the ideal goal of all science: a coherent theory of the universe. As Blumenthal (1985) demonstrated, Wundt's aim was to establish psychology as a foundational or preliminary science that would integrate the social and physical sciences.

In 1863, just one year after he published his first book, the prolific Wundt published another major work, the two-volume, 1,000-page *Vorlesungen über die Menschen-und Thierseele* (Lectures on the Human and Animal Mind). As the title indicates, the work is broad and inclusive, with about half the material continuing Wundt's presentation of cultural psychology.

Even though he had been able to develop his courses and was given a chance to write, Wundt became increasingly dissatisfied with his position at the Institute of Physiology. He resigned in 1864, which later prompted speculation that his relationship with Helmholtz had cooled. One of Wundt's early American students, G. Stanley Hall (Chapter 9), reported that Helmholtz found Wundt's knowledge of mathematics inadequate and so replaced him with a man of "severer and more accurate methods and greater mathematical knowledge" (Hall, 1923, p. 206). This speculation is not true, for, as Wundt himself remarked, Helmholtz needed no help with mathematics and wrote many letters of recommendation for his former assistant over a period of several years. In any event, having resigned from the Institute, Wundt was left without regular income. He still held his academic rank at the university (and had, in fact, been promoted to associate professor), but his position was without salary. Wundt established a small laboratory in his home and supported it and himself with royalties from his books.

Wundt became intensely interested in politics and was elected president of the Heidelberg Workingmen's Educational Association, an idealistic, socialistic group dedicated to improving conditions for working people. Wundt served as a member of the Baden Parliament for two two-year terms, but he became convinced that political life was not for him, and in 1871 he returned to the University of Heidelberg. There he held the rank of extraordinary professor for three years before accepting a call to the chair of inductive philosophy at Zurich. Wundt was at Zurich for just a year before being appointed to the chair of philosophy at the University of Leipzig. That chair had been vacant for ten years because the faculty had been unable to agree on an appointment. Wundt's interest in the new psychology and his recent political activism must have caused alarm among the more conservative members of the Leipzig faculty. With his characteristic self-deprecating humor, Wundt reported that the Leipzig faculty had decided to hire him and one other obscure candidate for the price of one man of distinction (Diamond, 1976, p. 527).

The First Experimental Psychology Laboratory

In 1876, the University of Leipzig assigned Wundt a room to store the demonstration equipment and experimental apparatus he had brought from Zurich. The room was in the *Konvikt* building constructed in 1840 by convicts to house a dining hall for poor students. At Leipzig, Wundt's first course was on physiological psychology. He emphasized that this new branch of science was to be objective and experimental. Wundt presented demonstrations and experiments during his lectures, but it became cumbersome to transport equipment back and forth from the storage area to the classroom, so a number of demonstrations were set up permanently in his room in the *Konvikt* building. Students would go there to observe the demonstrations and even to participate in simple experiments. This was the modest beginning of Wundt's Leipzig laboratory. Wundt's psychology was to become very much an experimental science of tachistoscopes, chronoscopes, electrical stimulators, pendulums, timers, and sensory mapping devices—a "brass instrument" psychology. A new student joining Wundt's laboratory was typically assigned a piece of apparatus for use in planned experiments or to develop and adapt for future research (Hilgard, 1987, p. 30). Wundt bought much of this original equipment himself, filling more and more rooms in the *Konvikt* building. In the autumn of 1879, Wundt began some psychological experiments that were not part of his course. Because he later suggested that these independent experiments marked the

The House of the Giant *(Haus zum Riesen)* building in Heidelberg where in the summer of 1865 Wundt established his first laboratory. The building still stands across from the Psychological Institute of Heidelberg University.
(From Wundt Studies: A Centennial Celebration *(p. 342) edited by W. G. Bringmann and R. D. Tweney, 1980. Toronto: Hogrefe.)*

formal establishment of his laboratory of psychology, historians have generally accepted 1879 as the date of the establishment of psychology as an independent experimental science. In 1979, the American Psychological Association authorized a special minting of a gold medal bearing Wundt's portrait on one side and proclaiming a "century of science" on the reverse.

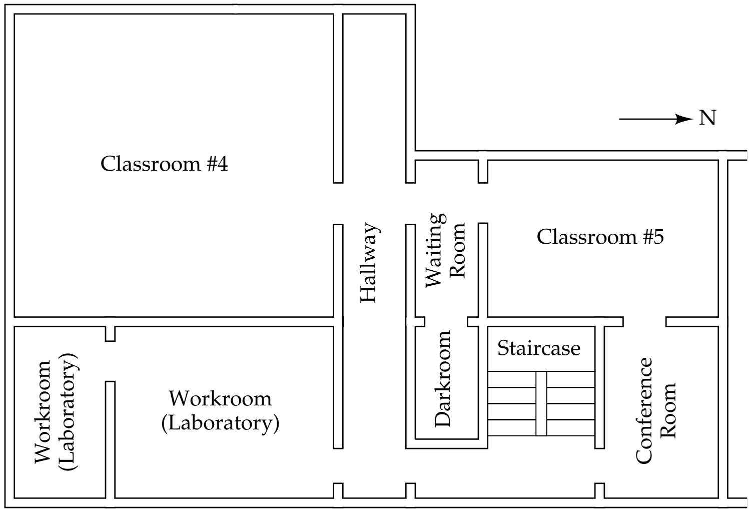
The Leipzig laboratory was in fact established over a number of years, and in 1879 Wundt's laboratory was still a primitive affair. It was not officially recognized and listed in the catalogue of the University of Leipzig until 1883. Even that belated action came only when Wundt threatened to accept an offer to move to the University of Breslau. Benjamin Wolman (1960, p. 11) has suggested that establishing this laboratory was an act of courage by Wundt. He had to face opposition from colleagues who questioned the legitimacy of psychology as an experimental science and maintained that continued self-observation would drive young persons to insanity. Despite this opposition, Wundt's laboratory grew; by the mid-1880s it occupied eight to ten rooms.[2] In 1893, the laboratory was moved to eleven rooms in a building formerly occupied by the department of gynecology; finally, in 1897, the Psychological Institute, as it was then called, moved to a new building that Wundt had designed expressly for psychological research. It is ironic that some of Wundt's most prominent students—Cattell, Kraepelin, Münsterberg, Külpe, Titchener, and Lipps—did their research in the *Konvikt* building. Wundt himself did little research in the new laboratory, since by that time his interests were primarily theoretical. Wundt's last laboratory was destroyed in an Anglo-American bombing raid on Leipzig during the night of December 4, 1943.

The Wundtian Theoretical System

In addition to laboratory exercises and demonstrations, Wundt needed a text for his course. In 1873 he began work on the two-volume *Grundzüge der Physiologischen Psychologie* (Principles of Physiological Psychology). The book had been planned for some time. In December 1872, Wundt had described it to Wilhelm Englemann, a potential publisher, as being physiological in that it used the inductive, experimental methods of that field, but also new in that those methods were applied in areas not considered in contemporary physiological texts. The book's subject matter was to fall somewhere between physiology and philosophy. By *physiological psychology,* Wundt did not mean what we mean today: the study of the physiological basis of behavior and consciousness. Rather, for Wundt, it meant a psychology using experimental techniques analogous to those used in physiology. The publisher accepted Wundt's book and published it in Leipzig in 1874. In the preface Wundt clearly outlined the book's domain:

> The book which I here present to the public, is an attempt to mark out a new domain of science. I am well aware that the question may be raised, whether

[2] A Belgian psychologist, Jules-Jean Van Biervliet, was trained in Wundt's laboratory in 1891. In 1892 he published an account of his experience, describing the courses he took, his research, the apparatus he used, and the library (Nicolas & Ferrand, 1999).



Wundt's Leipzig laboratory in 1883.
(From Wundt Studies: A Centennial Celebration *(p. 151) edited by W. G. Bringmann and R. D. Tweney, 1980, Toronto: Hogrefe. Reprinted by permission.)*

> the time is yet ripe for such an undertaking. The new discipline rests upon anatomical and physiological foundations which, in certain respects, are themselves very far from solid; while the experimental treatment of psychological problems must be pronounced from every point of view to be in its first beginnings. At the same time the best means of discovering the blanks that our ignorance has left in the subject matter of a developing science is, as we all know, to take a general survey of its present status. (Wundt, 1874/1904, p. v)

The phrases "new domain of science," "new discipline," "experimental treatment of psychological problems," and "developing science" show that Wundt was self-consciously trying to stake out a new area of science. Thus, he is the first person we can label without reservation a psychologist. Wundt's *Principles* was a success. The book went through major revisions and expansions in 1880, 1887, and 1893. Three-volume editions were published in 1902–1903 and 1908–1911. These books are the clearest statement of Wundt's experimental psychology and so must be considered in some detail.

First, Wundt described the "bodily substrate of mental life," or brain anatomy and function. Next he described the nervous system and presented his views on the forces that underlie nerve conduction. For the contemporary student of psychology, these sections are of little value as they have been superseded by more recent findings. Then Wundt discussed the characteristics of sensations; he identified quality, intensity, extent, and duration as the four fundamental characteristics of sensations and went on to develop a theory of perception. Part IV is the psychological heart of the book. There Wundt defined psychology as "the investigation of conscious processes in the modes of connection peculiar to them" (Wundt, 1874/1904, p. 2).

Well-established methods used in the physiological sciences were to be the model for the methods used in the new experimental science. However, Wundt stressed that those methods required modification to meet the specific requirements of psychological investigation. He commented that "psychology has adapted physiological, as physiology adapted physical methods to its own ends" (Wundt, 1874/1904, p. 3). The goal of psychology was the study of "conscious processes," or what Wundt considered part of "immediate experience," as opposed to "mediate experience." To illustrate the distinction, consider two stimuli: a green sheet of paper and a tone. If we use a spectrometer to measure the wavelength of the light reflected from the paper, or a sound spectrogram to measure the frequency and intensity of the tone, we are not studying the paper and the tone directly; the instruments *mediate* our experience of the green paper and tone. If we describe the conscious processes and experiences we have when the two stimuli are presented—the "greenness" of the green paper and the "highness" or "lowness" of the tone—we are describing our *immediate* or direct experience. According to Wundt, the first is the province of physics, the second that of psychology. Physicists attempt to study the external world without being a part of the situation or phenomenon they are examining. Psychologists, according to Wundt, do not study the external world *per se;* they study the psychological processes by which we experience and observe the external world. They cannot remove themselves from their objects of study since they are studying their own conscious processes.

While physicists have spectrometers, spectrographs, and many other wonderful instruments, what objective observational techniques does the psychologist have with which to study conscious processes? One technique Wundt described is *Experimentelle Selbst-beobachtung* (experimental self-observation). *Introspection* has been the word most frequently used to describe Wundt's method. The choice is unfortunate, for it may be taken to imply a type of armchair speculation, which was certainly not what Wundt meant. He dismissed such speculation as "contemplative meditation" that leads only to fruitless debate and the grossest self-deceptions (Wundt, 1874/1904, p. 7). In 1882, Wundt in a polemical paper compared earlier introspectionists to the Baron von Munchhausen, a comic character of German folklore who rescued himself from quicksand by pulling himself up by his own hair (Blumenthal, 1985, p. 29). Wundt's introspection was a rigidly controlled, arduous experimental procedure. He believed that, just as little had been learned about mechanics from casual, haphazard observations of falling bodies, little would be learned about human mental experiences from uncontrolled, contemplative meditations.

Wundt's observations were not limited to self-reports but included objective measures, including reaction times and word associations. In fact, the majority of experiments in Wundt's laboratory included such measures. Danziger (1979) surveyed nearly 180 reports from Wundt's laboratory between 1883 and 1903. He found just four articles containing only introspective reports. Whenever Wundt's researchers used introspection, they presented highly trained observers with carefully controlled sensory events and asked them to describe their mental experiences. To gain valid introspections, they enforced certain rules. The observer had to be "master of the situation," that is, in a state of "strained attention," knowing when the stimulus would be presented and when the observations would be made. All observations were to be repeated many times. Finally, experimental conditions would be varied systematically to allow a general description of mental contents.

In their introspections, Wundt and his students identified two basic elements of mental life: sensations and feelings. Complex, continually changing mental processes result from connections or creative syntheses of these elements. Wundt placed this principle of creative synthesis in direct opposition to what he considered the misleading *atomic elementism* of some nineteenth-century associationists. Arthur Blumenthal described this situation well:

> [The associationists] had atomized mental processes into elemental ideas that became associated into compounds according to classical associationist descriptions. Wundt considered that approach to be a mere primitive analogy to systems of physical mechanics, and he argued at length that these systems teach little about the relations of psychological processes. (Blumenthal, 1975, p. 1083)

For Wundt, sensations and feelings were not simply "billiard balls" that collide and interact. Like John Stuart Mill (Chapter 2), Wundt adopted a model of the mind that emphasized chemical rather than mechanical principles. For Wundt, the mind is a creative, dynamic, volitional force. It can never be understood by simply identifying its elements or its static structure. Rather, it must be understood through an analysis of its activity—its processes. In fact, the term *structuralist,* commonly applied to Wundt, was invented later by Edward Titchener (Chapter 5) and William James (Chapter 9); Wundt never used it. Instead, Wundt gave the name *voluntarism* to his psychology and stressed the difference between his *voluntarism* and Titchener's *structuralism* (Blumenthal, 1979, p. 549). Blumenthal has been largely responsible for clarifying our conceptions of Wundt's true position. He wrote:

> Today I cannot help but wonder whether Wundt had any notion of what might happen the day he chose the word "Elemente" as part of a chapter title. Later generations seized upon the word with such passion that they were eventually led to transform Wundt into something nearly opposite to the original. (Blumenthal, 1979, p. 549)

Blumenthal's remarkable conclusion was that Wundt was not in fact a *reductionist,* not an *elementist,* and not a *structuralist*—the three characteristics most often ascribed to him. Wundt did not define psychology as the science of the mind. That definition, like the term *structuralism,* also comes from Titchener. Wundt denied that "minds" exist to be studied apart from "bodies." He vehemently opposed mind-body dualisms and believed that mental experience must be studied in terms of both mind and body—the so-called double aspect resolution of the mind-body problem. Finally, Wundt's introspection was not a limited method of self-report but rather a collection of objective, experimental procedures more accurately labeled experimental self-observation.

Wundt's Research

When we turn to Wundt's research, we find a similar situation. Rather than performing a restricted, tedious, largely irrelevant series of experiments bounded by introspection, Wundt and his students actually did research on a range of topics—and, as we have seen, classical introspection had little if any part in many of their experiments.

Fortunately, we have an excellent historical record of the experiments Wundt and his students performed in their Leipzig laboratory. As the number of experiments increased, Wundt realized that he needed some way of presenting their results to a wider audience. His *Principles* was constantly expanded and revised, but the publication lag created the need for a journal which would allow the quick publication of results. In 1881, Wundt established the journal *Philosophische Studien* (Philosophical Studies) and published a first report of student Max Friedrich's experiment on the apperception of time. Wundt edited *Philosophische Studien,* the first journal devoted exclusively to psychological research, until 1902. Given Wundt's avowed goal of establishing psychology as a new science apart from both philosophy and physiology, why did he name his journal *philosophical* rather than *psychological* studies? Perhaps he hoped to retain the status of philosophy—or more practically, as Fancher (1996) suggests, he wanted to avoid confusion with an earlier journal *Psychological Studies* devoted to parapsychology (the study of psychic phenomena such as clairvoyance, telepathy, and extrasensory perception).

Edwin G. Boring (1929) and Robert Watson (1978) classified about a hundred of the experiments reported in *Philosophische Studien* during a twenty-one-year period and found that about 50 percent of the studies were concerned with sensation and perception: studies of color vision and contrast, afterimages, and visual illusions. Time perception was studied by having subjects estimate time intervals. Tactile sensations were studied using the psychophysical methods Ernst Weber and Gustav Fechner had developed (Chapter 6).

About 17 percent of the classified experiments measured reaction times; subjects had to respond after detecting or identifying a stimulus. Reaction times for identification were consistently longer than for detection; this was thought to be due to the time involved in the process of identification after the simple detection of the stimulus. These methods and assumptions appear reasonable, but around the turn of the century they were found to be inadequate. Observed reaction times varied greatly from subject to subject, in the same subject at different times, and from laboratory to laboratory. Reaction times simply did not yield the precise measurements of mental processes the Wundtians sought. Nevertheless, such measures have become ubiquitous in psychology (Luce, 1986, p. 1).

About 10 percent of the Leipzig experiments concerned attention. Wundt thought of attention as a mental process that creates a focus in consciousness. He defined *attention* as "the state which accompanies the clear grasp of any psychical context and is characterized by a special feeling" (Wundt, 1902, p. 229). Observers at Leipzig were trained in their introspections to distinguish between sensations and ideas in the *Blickfeld* (field of attention) and in the *Blickpunkt* (focus of attention). Wundt termed the mental process that brings mental

The History and Contemporary Use of Reaction Times

In London, one can take a pleasant excursion by sailing up the River Thames to the nearby town of Greenwich. Boats leave from Westminster Pier, next to the Houses of Parliament and across the river from the world's tallest Ferris wheel, the 450-foot-high London Eye. The trip gives a river view of many London landmarks. Greenwich, the site of the prime meridian, is a charming river town with a special place in the history of psychology. It was there in an astronomical observatory that astronomers made the first systematic observations of differences in individual reaction times.

In 1676, a house was built on a hill above Greenwich for England's "astronomical observator." Sir Christopher Wren, the architect of St. Paul's Cathedral, received a royal commission to provide "for the observator's habitation and a little for pomp." Up to that time John Flamsteed, the first astronomer royal, had made his observations from a turret in the Tower of London. At Greenwich, Flamsteed checked and rechecked the movements of stars, making accurate determinations of their positions. Greenwich also became the nation's—and later, the world's—official timekeeper. Each day a ball would be hauled to the top of a mast at the Observatory and dropped at precisely one o'clock. Mariners on the river would set their chronometers by "Greenwich Mean Time." Today, the time ball is still dropped precisely at one.

In 1796 at the Greenwich Observatory, Nevil Maskelyne, the fifth astronomer royal of England, and his assistant, a young man named Kinnebrook, were observing and recording the transit times of stars across the reticles[3] of their telescopes. The times they recorded sometimes differed by as much as a second, a difference which Maskelyne concluded was due to Kinnebrook's error. That unfortunate young man was dismissed from his position and from history; his name does not appear in an *Encyclopedia of Astronomy* (Satterthwaite, 1970). Ten years later, a German astronomer, Friedrich Bessel (1784–1846), read an account of this incident at Greenwich and concluded that Maskelyne and Kinnebrook had simply differed in their observation of reaction times. He measured the reaction times of many astronomers and found consistent individual differences. The astronomers went on to develop personal equations which allowed for differences between observers and so allowed them to work together.

In the late 1860s, Dutch physiologist Franciscus Cornelius Donders (1818–1889) studied reaction times under controlled laboratory conditions. He used as a timing device a clockwork Hipp-Chronoscope[4] that recorded time to thousandths of a second (Creelman, 1998). In his *simple reaction time* procedure, a person had to respond to a stimulus with a particular response. In his *choice reaction time* procedure, a number of stimuli were presented with different responses required for each one—for example, with the right hand if the light is red and with the left hand if the light is blue. Finally, in his *discrimination reaction time* procedure, several stimuli were presented in random order and the person was asked to respond to only one. Donders found that simple reaction times were consistently shorter than the other two types. Subtraction of simple reaction times gave Donders a measure

[3] The reticle of a telescope is a set of fine, parallel lines intersecting others at right angles on the object glass of the telescope.

[4] A Hipp-Chronoscope purchased in 1890 is in the University of Toronto Collection of Historical Instruments (Creelman, 1998).

The History and Contemporary Use of Reaction Times (Continued)

of the time it had taken to discriminate or choose. In a landmark paper entitled "On the Speed of Mental Processes" (1868), Donders described a stage model in which the individual first perceives the stimulus, then categorizes it, then selects the appropriate response. Each of these mental stages takes time, so the measured reaction time is assumed to be the additive product of the time it took to perform each mental operation. That stage model of mental processing underpinned the use of reaction time measures in Wundt's Leipzig laboratory. In a historical review of the development of modern cognitive psychology, Michael Posner and Gordon Shulman (1979) described Donders as one of the founders of cognitive psychology.

Wundt's first American student, James McKeen Cattell (Chapter 9), found that when subjects had to name a single presented letter, reaction time was about half a second. When a second letter appeared before the first one disappeared, the naming (reaction) time dropped by one-fifth of a second, and continued to decline as more letters were added. Cattell also found that naming times for unconnected words or letters were twice as long as times for connected ones. Cattell published his results in a seventy-two page report in *Philosophische Studien* in 1885 and in a three-page abridgement in the journal *Mind.* That paper, "The Time It Takes to See and Name Objects" (Cattell, 1886), is a classic in the history of psychology. Cattell concluded his paper with this confident assertion:

James McKeen Cattell, Wundt's first American student and a pioneer American psychologist.

> The relation of the sensation to the stimulus and the time taken up by mental processes are the two subjects in which the best results have been reached by experimental psychology. These results are important enough to prove those to be wrong who with Kant hold that psychology can never become an exact science. (Cattell, 1886, p. 63)

The last thirty or more years have seen the rise of cognitive psychology and the dominance of information-processing approaches to the study of learning and memory. In a now classic series of experiments, Saul Sternberg (1966, 1969) asked subjects to remember a set of letters and then a short time later asked them whether a probe letter was in the original set. Subjects responded "Yes" or "No" by pressing a button, so their reaction times could be measured. As the size of the original set increased from one to six letters, reaction times increased, with each additional item adding about 38 milliseconds to the reaction time. That result was predictable. What was surprising was that reaction times for "Yes" and "No" trials did not

(continued on page 128)

The History and Contemporary Use of Reaction Times (Continued)

differ. That suggested to Sternberg that in the very rapid search of the short-term memory store, the entire memory store is scanned in an exhaustive search, even after a match is found.

Allan Collins and M. Ross Quillian (1969) proposed that knowledge in semantic or long-term memory is organized in hierarchical structures or networks. They predicted that the more information nodes that must be passed in answering a question, the longer will be the reaction time. Their subjects took significantly less time to answer a question such as "Is a canary yellow?" than to answer "Is a canary warm-blooded?" Such differences were present whether or not the answer was actually correct.

Greenwald and Banaji (1995) extended the use of reaction times to how people feel about certain groups of individuals, or their implicit attitudes. Reaction times were used to estimate the degree of association between target concepts, such as attitudes towards African-Americans and white Americans, and evaluative dimensions such as pleasant/unpleasant, good/bad.

contents to the focus of attention *apperception.* Today we would call this *selective attention.* In 1919, one of Wundt's most eminent former students, Emil Kraepelin, applied a model of attention to the thinking of people with schizophrenia (Kraepelin, 1919). Kraepelin ascribed certain forms of schizophrenic behavior to reduced attention, highly erratic forms of attention, or extremely limited and poorly focused attention. Kraepelin's "impaired attention" theory of schizophrenia has seen a modern revival in information-processing approaches to the illness (Silverman, 1964; Boer et al., 1994). People diagnosed with schizophrenia show deficits in attention even after they recover from the illness. Children genetically at risk for schizophrenia show attention deficits similar to those of adults with the illness. Adults with schizophrenia have difficulty filtering out competing stimuli and so perform poorly on a divided-attention task (Gjerde, 1993). They also have difficulty clearing their working memory of distracting information (Schooler et al., 1997).

Another 10 percent of the experiments at Leipzig concerned feeling. Metronome beats were played to observers, who reported that certain rhythmic patterns were more pleasurable than others: there was a dimension of *pleasure* versus *displeasure.* The observers also reported a slight feeling of tension as they anticipated the next beat. Thus, a second dimension of feeling involving *strain and relaxation* was defined. Finally, at certain metronome rates, observers reported mild feelings of excitement, while at others they reported feeling calm. Thus, a third dimension of feeling—*excitement* versus *calm*—was identified. These three dimensions were combined in Wundt's three-dimensional theory of feeling. Wundt and his students devoted much effort to plotting various feelings on this three-dimensional matrix. In general, their efforts were unsuccessful, but when factor analysis techniques became available in the twentieth century, researchers developed a number of dimensional approaches to meaning and emotion (Osgood, Suci, & Tannenbaum, 1957; Schlosberg, 1954).

In studying feelings, the Wundtians also used a method of "paired comparisons": feelings were compared with each other and with a standard comparison feeling. The comparisons were made along the three dimensions that had emerged from earlier observations. In addition, measures of pulse rate, breathing, and muscle tension were taken as indices of the quality of feeling. This research anticipated today's psychophysiology.

Finally, about 10 percent of the studies reported in *Philosophische Studien* dealt with association. For Wundt, *association* was a process of combination in a passive state of attention. Single words were presented to a subject, who was required to respond with a single word. The Wundtians recorded both the response word itself and its latency. Wundt distinguished between inner associations based on intrinsic connections between the words (e.g., "lion-animal," "spear-shield," "cow-milk," and "white-black") and outer connections based on accidental, extrinsic connections which are often the product of a person's individual history (e.g., "curve-accident" and "father-hate"). Emil Kraepelin provided suggestive support for the greater clinical significance of these associations. He found that a subject under the influence of alcohol would increase the number of outer associations.

While Wundt directed the overall research in his Leipzig laboratory, much of the day-to-day supervision fell to his official assistants (Boring, 1957). Fifteen men held that position, including Cattell from 1885 to 1886 and Oswald Külpe (Chapter 6) from 1886 to 1893. Students usually worked on assigned experiments that often replicated earlier work. Danziger (1985) compared the psychological experiment as a social institution at Leipzig and in contemporary research laboratories. He found striking differences in the roles subjects and experimenters play. Today a clear difference in power and status favors the experimenter. Psychologists "run" their subjects, who often sign up for an experiment to meet a course requirement or receive a small payment. The experimenter is clearly in charge, and the subject does what he or she is instructed to do and then receives either a participation credit or a payment. In Wundt's laboratory, the subject's role was considered more important than that of the experimenter, since the subject was the data source. Subjects were highly trained, psychologically sophisticated members of the Leipzig laboratory. Sometimes they would alternate in the roles of subject and experimenter; at other times, the subject and the experimenter were the same person. Especially in the laboratory's early years, Wundt himself was often the subject. *Subject* was but one term used in Leipzig reports; others included *reactor, observer, participant,* and *individual under observation.* Research in Wundt's laboratory was intensive and cooperative, conducted with a small group of people. Danziger (1985) concluded that current role patterns in psychological experiments come not from Leipzig, but from studies in France on experimental hypnosis by medical investigators such as Jean Charcot (Chapter 11).

Wundt as Adviser

A wide variety of experiments were done at Leipzig. Without a large number of students, such a volume of research would not have been possible. Leipzig in the late nineteenth century was the center of the new science of psychology, and among Wundt's most important contributions to the development of psychology were the students he influenced. As early as 1867, William James (Chapter 9) wrote to a friend:

> It seems to me that perhaps the time has come for psychology to be a Science—some measurements have already been made in the region lying between the physical changes in the nerves and the appearance of consciousness. . . . I am going to study what is already known, and perhaps may be able to do some work on it. Helmholtz and a man named Wundt at Heidelberg are working at it and I hope, if I live through this winter, to go to them in the summer. (James, 1867, quoted by Roback, 1961b, p. 76)

James did live through the winter and spent some time with Wundt. However, as we will see in Chapter 9, James quickly concluded that Wundt's psychology was not what he was looking for. Other students found their Leipzig experience more worthwhile. Between 1875 and 1919, Wundt directed 186 Ph.D. theses (Tinker, 1932). Of these, 70 were in philosophy and the remainder were on psychological topics (Fernberger, 1933). The majority of these students (136) were from Germany and Austria. Reading their names, Samuel Fernberger (1933) recognized only 34 of them. Why didn't many more of Wundt's students attain prominence? Possibly they would be better known to German psychologists, or perhaps, as Fernberger speculated, most of these Ph.D. students went on to a career in the German *Gymnasium* system. As we have seen, that system emphasized excellence in teaching and the close supervision of students. Research was not encouraged or required, and so they did not contribute to the literature of psychology. However, Wundt did have some notable European students.

In addition to Emil Kraepelin, who has been mentioned, Hugo Münsterberg, whose career will be described in more detail in Chapter 5, made early advances in applied psychology. Wundt's students from France included Viktor Henri, who collaborated with Alfred Binet in formulating the first intelligence tests (Chapter 11), and B. Bourdon, who in 1896 founded the second French psychological laboratory at Rennes. From Russia, Vladimir M. Bekhterev, one of Pavlov's contemporaries, developed a unique theory of conditioning and a system of psychology. Wundt's students from England included the statistician and psychometrician Charles Spearman as well as Edward Titchener, the individual responsible for bringing a refined version of the Wundtian system to America. These are important names in the history of psychology, but Hugo Eckener was the most famous of all of Wundt's German doctoral students. He commanded the dirigible *Graf Zeppelin* on its many flights around the world, was honored with two ticker-tape parades in New York City, and was voted the best-known man in the world in a 1930s newspaper poll. The *New York Times* ranked Eckener as an explorer in a class with Robert E. Peary, Roald Amundsen, Ernest Shackleton, and Richard E. Byrd and as an aviator in a class with Charles Lindbergh (Vaeth, 1958). Doing his dissertation research on the effects of irritation and annoyance on attention, Eckener received his Ph.D. under Wundt in 1893.

Sixteen students from the United States followed Cattell and received their degrees from Wundt. The titles of their dissertations are evidence of the diversity of research done in Wundt's laboratory. The students included Harry Kirke Wolfe, whose 1886 dissertation was on "Memory for Tones." Wolfe established the Department of Psychology at the University of Nebraska (Benjamin, 1987, 1991). Frank Angell ("Studies on the Estimation of Sound Intensity"), Edward Scripture ("Thinking and Feeling"), and Edward Pace ("Spencer's Theory of Evolution") all completed dissertations in 1891. They founded psychology laboratories at Stanford, Yale, and Catholic University, respectively. The first psychological clinic in the United States was founded in 1896 by Lightner Witmer (Chapter 8). He wrote his dissertation on "Aesthetic Values of Varying Proportions" and received his degree in 1892. George Stratton, the founder of the psychological laboratory at the University of California (and author of "The Perception of Changes of Pressure at Varying Rates"), and Charles Judd, founder of the Department of Educational Psychology at the University of Chicago and the psychology laboratory at New York University ("Perceptions of Space"), both received degrees from Wundt in 1896. Judd also translated Wundt's *Outline of Psychology* into English. In 1900, Walter Scott, who started the Department of Psychology at Tufts University, received his degree under Wundt with a dissertation on "The Psychology of Impulses." The chairman for twenty-four years of the Department of Psychology at the Ohio State University, George Arps, wrote his dissertation on "The Increase of the Perception of Pressure" and received his Ph.D. with Wundt in 1908.

Wundt also attracted students from other countries, including India and Japan. Blumenthal described Wundt's impact on those students:

> In 1920, the year of Wundt's death, his Japanese students and followers were constructing a replica of the Leipzig laboratory at Tokyo University. It survived World War II, only to be burned in a student riot during the 1960s. In 1932, the centenary of Wundt's birth, the Indian *Journal of Psychology* and some followers of Wundt at Calcutta produced the largest commemorative volume on Wundt printed that year. (Blumenthal, 1975, p. 44)

Wundt not only founded psychology but also trained a substantial cohort of the first generation of psychologists. By 1900, there were forty-three psychological laboratories in the United States, twelve of which had been founded by Wundt's doctoral or nondoctoral students (Garvey, 1929). Four of the first five distinguished psychologists listed by Cattell in 1903—James, Cattell, Münsterberg, and Hall—had studied at Leipzig with Wundt. John MacEachran, a longtime faculty member at the University of Alberta, was a Wundt Ph.D. (Arvidson, 1971). Wundt so influenced the first generation of psychologists that most psychology students can probably trace their historical lineage back to him (Boring & Boring, 1948; Granello, Hothersall, & Osborne, 2000). Few of Wundt's students remained true to his teachings and approach to psychology, but they earned their Ph.D.s under him and in different ways represented the new psychology.

Wundt as Writer

Throughout his career, Wundt was a prolific writer. His first three books were followed in 1880 and 1883 by two volumes of his *Logic,* which went into four editions. His *Ethics* (1896) went into five editions, and his *Grundriss der Psychologie* (Foundations of Psychology) (1896) went into fifteen. In 1889 he published his *System der Philosophie*, and between 1900 and 1920 he published the ten-volume *Völkerpsychologie*, which we will discuss shortly. Finally, his *Einführung in die Psychologie* (Introduction to Psychology) came out in 1911, and in 1920 *Erlebtes und Erkanntes* (What I Have Experienced and Discovered) was published. The full bibliography of his work includes 491 items. Boring (1957) computed a total of 53,735 published pages, giving Wundt an average publication rate throughout his career of 2.2 pages per day, or one word every two minutes, day and night, for sixty-eight years (Boring, 1957, p. 345). Envious of Cattell's American (Remington) typewriter, Wundt ordered one of his own—thus, it has been claimed, more than doubling his already prolific publication rate (Hillix & Broyles, 1980, p. 432). What would Wundt have achieved with a word processor? Watson estimated that the average reader at the rate of sixty pages a day would need nearly two and a half years to go through Wundt's entire works (Watson, 1968, p. 272). Surely this prodigious output will never be matched. If nothing else, it shows Wundt's industry, and it is especially impressive when one learns that for the last half of his life Wundt suffered from strabismus of the right eye, making writing and reading difficult.

Despite this prolific output, Wundt's works are little read today. Only disconnected segments have been translated into English, and his writing style in German produces immediate discouragement. G. Stanley Hall described Wundt's writing style as being as solid as lead but just as lusterless; George Miller referred to Wundt's genius as "the kind Thomas Edison described as 1 percent inspiration and 99 percent perspiration" (Miller, 1962, p. 24). In a letter to Stumpf, James described Wundt as aiming to be "a sort of Napoleon of the intellectual world. Unfortunately he will never meet his Waterloo for he is a Napoleon without genius and with no central idea which, if defeated, brings down the whole fabric in ruin." According to James, while critics were able "to make mincemeat of some of his views, he is meanwhile writing a book on an entirely different subject. Cut him up like a worm and each fragment crawls" (James, 1887, in Perry, 1935, vol. II, p. 68). Even Wundt's most loyal student, Titchener, admitted:

> Wundt's style has often, of later years, been termed diffuse and obscure. I should not care to call it either of these things; but I am sure that it is difficult. It has, perhaps, in a somewhat unusual degree, the typical characteristics of scientific German; the carelessness of verbal repetitions, the long and involved sentences, the lapses into colloquialism and what not. (Titchener, 1904, in Hillix & Marx, 1974, p. 118)

Wundt's Lifelong Interest

The project that concerned Wundt most during the last two decades of his life was his *Völkerpsychologie* (Cultural or Ethnic Psychology), published in ten volumes between 1900 and 1920. This major work has been largely ignored by historians of psychology. Boring (1929), in his 700-page *History of*

Experimental Psychology, discussed it in less than a page. Recently, however, much more attention has been paid to this work, which was clearly a major undertaking (Blumenthal, 1975, 1979; Schneider, 1990). But the question remains: Why has this work been so neglected? Blumenthal's explanation is that rather than reading Wundt directly, psychologists have developed a number of "myths of origins," which are passed on from one generation to the next and which do not include the *Völkerpsychologie.* Another explanation is that much of our knowledge of the history of psychology comes from Boring's classic *History of Experimental Psychology* (1929). History may repeat itself, but historians repeat each other. Boring dedicated his book to his teacher, Titchener, describing him as experimental psychology's "historian *par excellence,*" and offered his work with "great diffidence" as a "poor substitute" for the book Titchener should have written. Boring reflected Titchener's view that Wundt's writings on cultural and ethnic psychology were of little importance. As Titchener had said:

> I wish, however, to linger a little over the *Völkerpsychologie* in order to protest a belief, current in recent years and in some measure encouraged by Wundt himself, which I take to be grounded at best in a half truth. A legend has grown up—I cannot call it anything else—to the effect that social psychology was Wundt's first and fondest love, and that all of his life up to about 1890, was spent in clearing intruders out of the way, that he might ultimately return to it. In part the long stretch of years devoted to the *Völkerpsychologie* may be responsible; in part, as I have just said, certain statements of Wundt's own subscription; I should not accept this legend if it came with Wundt's own subscription; I should mistrust an old man's memory. I do not think that anyone can accept it who knows intimately the course of Wundt's development as his books portray it. (Titchener, 1921b, p. 169)

Titchener dismisses the ten-volume work as being due to nothing more than Wundt's lifelong weakness for "troublesome subjects of a certain sort" (Titchener, 1921b, p. 169). In a remarkable footnote, Titchener states that during his second year as a graduate student at Leipzig, he "succeeded in pigeonholing Wundt" (1921b, p. 170). The *Völkerpsychologie* did not fit into the pigeonhole Titchener had made for Wundt, and so he ignored it. As a result, our perception of Wundt's interests through the years may not be accurate. Contrary to Titchener's assertions, Wundt had long been interested in topics that he felt could not be studied experimentally. Wundt had defined "folk or ethnic psychology" in the introduction to his first book, *Contributions Toward a Theory of Sense Perception*, in 1862, and he remained interested in social or ethnic psychology throughout his career. The *Völkerpsychologie* was republished in 1990 (Schneider, 1990) to favorable reviews (Brock, 1992, p. 380).

Blumenthal found other evidence of Wundt's interest in a broad range of psychological topics. In the *Völkerpsychologie,* Wundt wrote that studies of animals were important because

> the animal kingdom exhibits a series of mental developments which may be regarded as antecedents to the mental development of man, for the mental life of animals shows itself to be throughout, in its elements and in the general

> laws governing the combination of the elements, the same as the mental life of man. (Wundt, 1902, p. 308)

In a similar vein, Wundt advocated psychological studies of children. In such studies, he would describe the development of such complex mental processes as language.

Wundt the Man

Opinions about Wundt's personality differ. James described Wundt as "the finished example of how much *mere education* can do for a man" (emphasis in the original; James, 1887, in Perry, 1935, vol. 2, p. 69). In letters he wrote from Leipzig, Cattell was often critical (all in Sokal, 1981):

> Wundt's laboratory has a reputation greater than it deserves—the work done in it is decidedly amateurish. (January 1885, p. 156)

> I was invited by Prof. Wundt to supper with other members of the laboratory. I can't say that I enjoy such things. I have no special reverence for any one I know personally, and it gives me no special delight to hear Wundt talk about opera and such like. Mrs. Wundt is however nice and Prof. Wundt seems to like me and to appreciate my phenomenal genius.[5] (February 1885, p. 160)

In another letter, Cattell described Wundt as "scarcely a great man" (November 1885). These critical comments are unfair to Wundt, who was generous in his support of Cattell. They were probably at least partly due to the stress of his research work and studies.

Hall (1924) gave an unflattering portrait of the Wundt he encountered at Leipzig, describing him as "an indefatigable worker, and we rarely saw him outside his laboratory although even there he spent little time and did little work, most of it being done in his study at home. He also impressed me as being rather inept in the use of his hands" (Hall, 1924, p. 206). Even Titchener described Wundt as "humorless, indefatigable, and aggressive" (Titchener, 1921b, p. 175), but more often he and other students were generous in their praise of Wundt. Titchener gave a warm account of the Christmases they spent in Leipzig with Wundt, his English-speaking wife, Sophie, and their children. Titchener remembered Wundt as being

> unassuming, cordial, tolerant; by no means given to monologue; showing frequent flashes of a pleasant, wholly academic humor. There was no trace, as one sat with him in his own study, of the roaring lion of controversy or the somewhat Olympian arbiter of science and philosophy. (Titchener, 1921b, pp. 175–176)

Unintentionally, Cattell paid a compliment to Wundt in one of his letters:

[5] Cattell's self-evaluation makes it easy to understand why Wundt considered him *ganz Amerikanisch*—that is, stereotypically American in his independence and self-confidence.

> Professor Wundt came to see me this morning. He stayed three-quarters of an hour and was very cordial, as he has always been recently. He has treated me very nicely, considering that I have called attention to mistakes in his work. (November 1884, in Sokal, 1981, p. 139)

Wundt showed his sense of humor in his recollection of a school examination in psychology that he attended. The schoolmaster had brewed his own psychology, which he required his pupils to learn by heart. In the course of the examination, each question concerning the nature of the soul, life, mind, and body was answered by the student with the utmost exactness. When Wundt was asked later by another master whether the pupils were "well up" in psychology, he replied, "Yes, indeed, out of all those questions I could not have answered one" (Wundt, 1877, quoted by Blumenthal, 1979, p. 550). Wundt must have been kind to his own students during their examinations, for Anna Berliner, Wundt's only female Ph.D., remembered him as "the kindest and most helpful examiner I have ever experienced" (Berliner, 1971, p. 516).

Wundt deplored the stodgy atmosphere of German universities. As a lively and stimulating lecturer who, unlike most of his colleagues, did not read prepared material, he attracted large audiences of Leipzig undergraduates. He was one of the first lecturers at Leipzig to use lantern slides and to bring demonstrations and experimental apparatus into his classes. Just as he had done at Heidelberg, Wundt used such demonstrations and experiments to complement and support his lectures. Titchener gave the following description of Wundt's lecture style:

> Wundt would appear at exactly the correct minute—punctuality was essential—dressed all in black and carrying a small sheaf of lecture notes. He clattered up the side aisle to the platform with an awkward shuffle and a sound as if his soles were made of wood. On the platform was a long desk where demonstrations were performed. He made a few gestures—a forefinger across his forehead, a rearrangement of his chalk—then faced his audience and placed his elbows on the bookrest. As he talked his arms and hands moved up and down pointing and waving, in some mysterious way illustrative. His head and body were rigid, and only the hands played back and forth. He seldom referred to the few jotted notes. As the clock struck the hour, he stopped, and stooping a little, clattered out as he had clattered in. (Titchener, quoted by Miller, 1962, pp. 19– 20)

Wundt was to teach more than 24,000 undergraduates in this manner. Later, at Cornell University, Titchener, in the style of his teacher, was to clatter in and out of *his* lectures.

In 1889, Wundt served as the University of Leipzig's rector, and in 1902, in recognition of his achievements and contributions, the city of Leipzig made him an honorary citizen. However, during the last two decades of his life, Wundt gradually withdrew from experimental psychology. Wilhelm Wirth was appointed codirector of the Leipzig institute in 1908, leaving Wundt free to concentrate on his writings. Wundt retired from the University of Leipzig in 1917.

Wundt retained an intense interest in politics throughout his life. During World War I he ardently supported the German cause with pamphlets and articles, insisting that Germany had been forced to enter the war because its existence as a great power had been threatened. He was one of ninety-three signatories to a manifesto proclaiming Germany's invasion of Belgium an act of self-defense. In September 1914, Wundt gave a speech at the University of Leipzig in which he adamantly argued that the war was due to a conspiracy by the participants in the "friendly agreement": England, France, and Russia. Wundt believed that those powers were motivated by envy and jealousy, a desire for revenge, and a dream of power, respectively. Of the three, Wundt saw England, and especially its late king, Edward VII, as the archvillains responsible for the war. Wundt said:

> But the chief guilt for kindling this world conflagration lies with England. Without the instigation of the English, without English money and the English fleet, there would at least have been contact within the limits in which an honorable trial of strength had always seemed possible. England first made it into a world war. (Wundt, 1915, p. 11)

After his death, the *Times* of London stated that Wundt would have been more honored had he died earlier (Cattell, 1921, p. 158). Small wonder that Titchener referred to Wundt's wartime writings and activities as something psychologists "can only try to forget" (Titchener, 1921b, p. 163).

Wundt in Perspective

Since Wundt began performing experiments independent of classroom demonstrations in his laboratory in 1879, and since he is often given credit for founding psychology as a discipline separate from both philosophy and physiology, the American Psychological Association selected 1979 as the centennial year of psychology. Yet Blumenthal characterized Wundt as the founding father of psychology that most psychologists have never known (Blumenthal, 1979). Why? Wundt is usually remembered as an advocate of a rather narrow approach to psychology—introspection—and as a strict experimentalist. But as we have seen in this chapter, his psychology was actually quite broad; his early *Vorlesungen* and his later *Völkerpsychologie* are testaments to his lifelong interest in a wide range of topics that could not be studied using a strict experimental approach and controlled introspection. Wundt was not merely an *elementist* interested only in the *structure* of the mind. That description would fit Wundt's student, Titchener, much better, and it is from Titchener that we have received many of our ideas about Wundt. It is no wonder that Wundt's son, Max Wundt, described the picture of his father's work in most psychology texts as nothing more than a caricature (M. Wundt, 1944).

Wundt died peacefully on August 31, 1920, two weeks after his eighty-eighth birthday. As we have seen, his many students, especially those from America, went on to found psychological laboratories and departments of psychology. Two of his students from Europe, Edward Titchener and Hugo

Münsterberg, also had major roles in the early development of psychology in America. Ironically, Titchener's approach and work are remembered, but he no longer has a following, whereas the work of Münsterburg has been largely forgotten, but the concerns he had and the approach he took are being taken up by contemporary psychologists.

Edward Titchener.
(Brown Brothers)

CHAPTER 5

Edward Titchener and Hugo Münsterberg

Edward Titchener and Hugo Münsterberg both emigrated to the United States in 1892. Each man directed a major psychological laboratory, Titchener at Cornell and Münsterberg at Harvard. They lived the remainder of their lives in the United States. Though neither became an American citizen, they were both influential figures in American psychology. There, however, the similarity ends.

Histories of psychology often present the psychological systems of Wundt and Titchener as similar, with Titchener's *structuralism* described as the true American representative of Wundt. Their psychologies were in fact so different that one historian has described Titchener's psychology as "the mistaken mirror" of Wundt's (Leahey, 1981). Titchener's psychology became more restricted and inflexible than Wundt's. He excluded from the domain of psychology anything that could not be studied using rigidly controlled introspection. Consequently, there was no room for Wundt's cultural anthropology, comparative psychology, or child psychology within the Titchenerian system. Titchener adopted only one aspect of Wundt's psychology—the study of sensation by trained introspection—refined it, and turned it into what he termed *structuralism,* the study of the *structure* of the conscious mind.

For two decades, Titchener dominated American psychology as no psychologist has since. Despite his prolific publications and the rigor of his experimental research, his system failed. Titchener's writings and research are rarely cited in the contemporary literature of psychology and then only in a historical context. Titchener's ascent, dominance, and decline are fascinating to consider.

Münsterberg's psychology was broader, more varied, and less amenable to the academic rigor that dominated everything Titchener did. In contrast to Titchener, Münsterberg played his life on a large stage, as the friend of presidents and Kaisers; a major public figure, a controversial speaker and popular writer, and a man who, when he died in 1916, was hated by more Americans than any psychologist before or since. Münsterberg's unjustified infamy is probably the reason why, until recently, his many applications of psychological knowledge to psychotherapy and to industrial and forensic psychology have often gone unrecognized. Today there is an increased interest in Münsterberg and an appreciation for his many contributions. Two major biographies (Keller, 1979; Hale, 1980) complement an earlier, understandably favorable biography by Münsterberg's daughter Margaret (Münsterberg. M, 1922). Today's psychologists have recognized Münsterberg's many important contributions to applied psychology (Moskowitz, 1977), have assessed his status as "victim or visionary" in the history of psychology (Landy, 1992), and have described his "rise and fall" (Spillmann & Spillmann, 1993).

EDWARD BRADFORD TITCHENER (1867–1927)

Titchener was born January 11, 1867, in the old Roman town of Chichester, Sussex, some seventy miles south of London toward the English Channel coast. The town is famous for its Roman ruins, which Titchener must have explored as a boy. His family traced its ancestry, which included schoolteachers, lawyers, and a former mayor of Chichester, to 1532. Titchener's father died in his thirties, and during Titchener's childhood the family was financially insecure. Fortunately, Titchener was a brilliant student who won a number of scholarships, including a highly competitive one to Malvern College, an English public school. Malvern was not one of "the" public schools—Eton, Harrow, Winchester, Rugby, Charter-House, Westminster, or Shrewsbury—but it provided an excellent, if expensive, education. English "public" schools are, in fact, private and charge hefty fees. In the nineteenth century less than 1 percent of all English schoolchildren attended public schools. Yet the public school graduates, or "old boys," formed a disproportionately large part of the enrollment at British universities, particularly at the two most prestigious: Oxford and Cambridge. Titchener's family wanted him to go to Cambridge, but the independent Titchener chose Brasenose College, Oxford, and entered that university in 1885.

At Oxford, Titchener was an "exhibitioner," or scholarship holder, who wore a middle-length academic gown with sleeves rather than the shorter, sleeveless gown of most Oxford undergraduates. Such subtle distinctions and marks of status were important to Titchener all his life. Years later, when the president of Cornell University invited him to dinner, Titchener refused because the president had not personally delivered the invitation. When the president protested that he was too busy for such social niceties, especially with new members of the faculty, Titchener suggested that he send the invitation with his coachman. The president complied, and Titchener attended the dinner (Boring, 1927, p. 495). Titchener invariably wore his Oxford gown to his lectures at Cornell. The gown, he said, "confers the right to be dogmatic" (Boring, 1952, p. 31). In the 1960s, the entrance hall to his son's Columbus, Ohio, home was dominated by a formal portrait of Titchener in full academic regalia.

Titchener studied classics and philosophy at Oxford, but he was also drawn to the writings of Charles Darwin and Thomas H. Huxley (Chapter 9). In his fifth year, he worked in the laboratory of the Oxford physiologist John Scott Burdon-Sanderson (1828–1905), conducting what today would be described as research in comparative psychology or ethology—studies of the protective coloration of eggs and the palatability of insects (Titchener, 1889; Dewsbury, 1992). Titchener also translated Wundt's *Principles of Physiological Psychology* into English.

Titchener graduated in 1890 at the age of 23 with a bachelor's degree and a deep interest in the new science of physiological psychology. Later that year, he traveled to Leipzig to study under Wundt. Titchener was fluent in German, was an admirer of German culture and society, and had been impressed by Wundt's psychology. Titchener took his translation with him to Leipzig, hoping to publish it, but found that the prolific Wundt was about to publish a new edition. Titchener's time at Leipzig confirmed his commitment to the new science of psychology. He received a Ph.D. degree under Wundt in 1892, writing his dissertation on "The Effects of Binocular and Monocular Stimuli." For the rest of his life, he considered himself a true Wundtian. It comes as something of a surprise to find that Titchener spent just two years at Leipzig, but those years obviously had a lasting effect.

After receiving his degree, Titchener served as an extension lecturer in biology at Oxford for a couple of months (he had published ten papers on biology and so was qualified to do so). No doubt he hoped for a regular position, but psychology was not taught at Oxford.[1] Frank Angell (1857–1939), one of the first American students at Leipzig, had received his Ph.D. under Wundt in 1891. Angell returned to the United States and established a laboratory of psychology at Cornell, supported by a bequest from a person interested in phrenology! When Angell accepted a position at Stanford University, he recommended Titchener to Cornell.

Titchener arrived at Cornell in 1892. After Oxford and Leipzig, he must have found Cornell a strange and alien environment. The campus had a raw, unfinished look (Boring, 1927). Titchener's first Cornell doctoral graduate, Margaret Floy Washburn, recalled a European visitor's description of his time at Cornell as "a year in the wilderness" (Washburn, 1932, p. 341). Perhaps this alien environment caused Titchener to become even more dependent on his Oxford-Leipzig past than would have been the case at a well-established university. He was to remain at Cornell until his death thirty-five years later, "an Englishman who represented the German psychological tradition in America " (Boring, 1957, p. 410).

Titchener had accepted Wundt's psychology without reservation. At Cornell, he modeled not only his psychology, but also his laboratory and lifestyle on Wundt's. Boring (1927) suggested that Titchener acquired many of his attributes and characteristics from Wundt, and that certainly seems to have been true. But it is also true that he acquired them from the Wundt he remembered and not necessarily the actual Wundt. Nevertheless, his view of Wundt is important in understanding Titchener and his psychology.

Titchener's Version of Wundt

A similarity that Titchener most certainly shared with Wundt was the use of demonstrations in his lectures. At Cornell, these often were elaborate, full-scale

[1] Boring (1957, p. 489) reported an earlier incident at Trinity College, Cambridge. In 1875, a philosopher, James Ward, proposed that the university establish a laboratory of psychophysics. A Cambridge mathematician protested that such an undertaking would "insult religion by putting the human soul in a pair of scales." Ward's proposal was rejected. Though often repeated, Boring's report is now considered apocryphal (Valentine, 1999, p. 205).

Margaret Floy Washburn in Titchener's Laboratory at Cornell

Given the times, it is a surprise that Titchener's first graduate student was a woman, Margaret Floy Washburn. Who was this remarkable person? In her autobiography, Washburn described herself as a young woman interested in psychology and reported on her experience at Cornell, together with making a frank assessment of Titchener:

> At the end of my senior year (1890) I had two dominant interests, science and philosophy. They seemed to be combined in what I heard of the wonderful new science of experimental psychology. Learning of the psychological laboratory just established at Columbia by Dr. Cattell, who had come a year before from the fountain-head, the Leipzig laboratory, I determined to be his pupil, and my parents took a house in New York for the year. But Columbia had *never* admitted a woman graduate student: the most I could hope for was to be *tolerated* as a *"hearer,"* and even that would not be possible until after Christmas when the trustees had met. (Italics added; Washburn, 1932, p. 338)

After Christmas, Washburn was admitted to Cattell's laboratory. There Cattell earned Washburn's affectionate gratitude by treating her as he did his four male students. She attended lectures and seminars and conducted research on tactile discrimination thresholds. At the end of that year, no fellowships were available, so Cattell encouraged Washburn to apply to Cornell:

> I went in the fall of 1892, to Cornell, where Titchener had just arrived from Oxford and Leipzig. He was 25, but seemed older at first sight because of his square-cut beard; the illusion of age vanished on acquaintance. There was nothing about him at the time to suggest either his two greatest gifts or his chief failing in later life. The gifts, in my opinion, were his comprehensive scholarship, shown conspicuously in his *Instructor's Manuals of Experimental Psychology,* and his genius as a lecturer. . . . The failing that later grew upon him was that of remaining isolated as far as his immediate surroundings were concerned from all but subordinates. In these first years he was entirely human. He once asked me to look over some proof; finding a sentence whose meaning was obviously inverted, I asked, "Didn't you mean so-and-so?" "Of course I did, ass that I am!" was the

productions requiring the work of a number of assistants. Titchener insisted that he give the elementary lectures as well as the advanced and that the laboratory staff attend them. Often Titchener, like Wundt, used these introductory lectures to present new findings from the laboratory or new developments in his psychological system. Titchener was a powerful lecturer who attracted large numbers of undergraduate students. What must their reactions have been to his psychology?

Like his teacher, Titchener was a prolific writer. His 216 works (Dallenbach, 1928) include six major books; the most important was his *Experimental Psychology,* published in four volumes between 1901 and 1905. Titchener had a didactic writing style and certainly never overestimated the psychological sophistication of his readers. Since they were "beginners" in psychology who needed to follow a "primer" or "text," everything was spelled out and explained.

Like Wundt, Titchener defined the problems his students should study and dictated the methodology they should use, but he was even less flexible when anyone challenged the basic assumptions of his psychological system. Persistently, Titchener made certain that he and his students in the Cornell labora-

Margaret Floy Washburn in Titchener's Laboratory at Cornell (Continued)

hearty response, a response that I fancy would have come far less heartily a few years later. I was his only graduate student, and experimental psychology was so young that he did not quite know what to do with me. (Washburn, 1932, p. 340)

Washburn was a successful graduate student. Her dissertation, "On the Influence of Visual Imagery on Judgments of Tactual Distance and Direction," was published by Wundt in *Philosophische Studien.* That was an unusual recognition for research by a psychologist who was not a Leipzig student. In 1894, Washburn was the first American woman to receive a Ph.D. in psychology. Even with her academic credentials, an academic position was difficult to find. Washburn even considered teaching psychology in a New York finishing school. Eventually she found a position at Wells College, where she taught Ethics and Psychology for six years. Opportunities for research were restricted. In 1900, Washburn returned to Cornell, where she conducted research on visual phenomena. In a seminar presentation, Washburn compared Münsterberg and Ebbinghaus favorably with Wundt. Titchener criticized her presentation. No one in the seminar supported her position because of their awe for Titchener. Washburn found it exciting to "draw blood" from him (Washburn, 1932, p. 344).

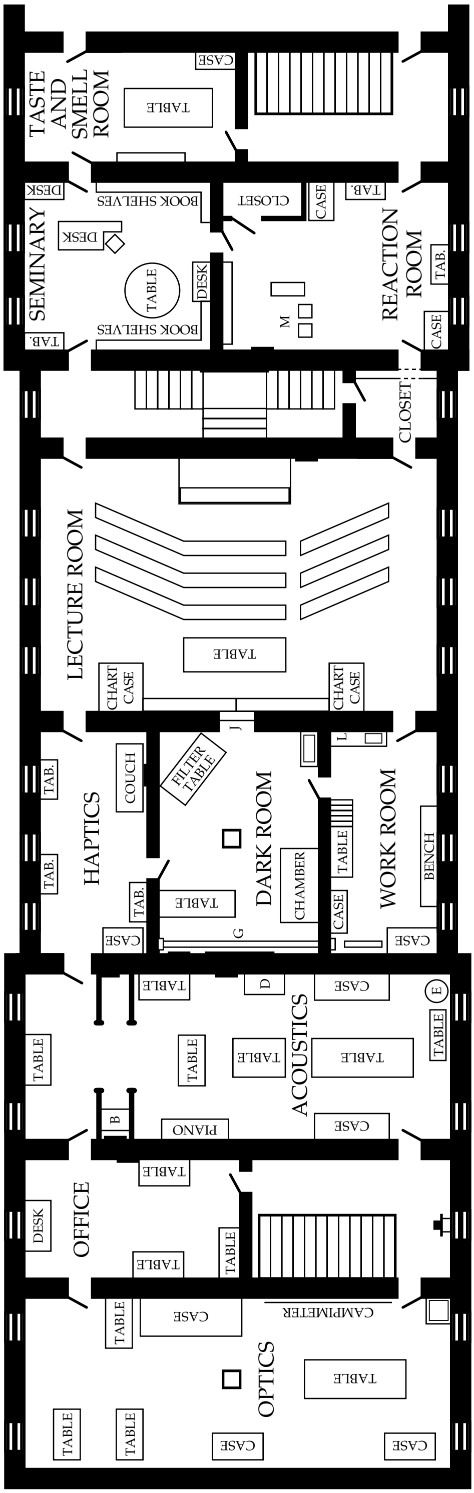
From 1903 to 1937, Washburn was a leader of the department of psychology at her *alma mater,* Vassar. She directed an active research program with Vassar students, and many of those women went on to earn advanced degrees in psychology. In 1908, Washburn published *Animal Mind,* a comprehensive survey of perception, learning and memory in a variety of species and the first comparative psychology text. Throughout its four editions, her book was the standard comparative psychology text (Dewsbury, 1992).

In 1921, Washburn was elected president of the American Psychological Association, the second woman to hold that position. In 1929, she was elected to membership in the prestigious Society of Experimental Psychologists.

tory followed the "true" psychology, allowing no room for the diversity of his teacher's *Völkerpsychologie.* Consequently, for Titchener more than for Wundt, psychology was an experimental, laboratory, "brass-instrument" science. He made a considerable effort to build up his laboratory and published a number of papers describing it as the model psychological laboratory.

Titchener's Psychological System: Structuralism

At Cornell, Titchener taught his students the experimental psychology he remembered from Leipzig, defining it in a relentless stream of lectures, papers, and books. For Titchener, psychology was "the science of the mind" (Titchener, 1916, p. 2). Furthermore, it was the study of the normal, human, adult mind, not the study of the minds of children, animals, or the insane. Titchener's psychology was concerned with the generalized mind, not with individual minds. Titchener seemed never to tire of warning the reader that what psychologists mean and what the layperson means by *mind* are very different. The layperson's conception of the mind is something inside the head that thinks,



Titchener's research laboratory at Cornell, first occupied in 1895.
(From "A Century of Psychology: From Subject to Object to Agent" by W. Kessen and E. D. Cahan, 1986, American Scientist, 74, *p. 644. Reprinted by permission.)*

learns, and remembers—an internal, mental mannikin. Such a conception, Titchener said, is fruitless. If we explain thinking, for example, as being due to the activity of the mind, we have in fact explained nothing. We are still left with the problem of accounting for the actions of the mental mannikin. For Titchener (1916, p. 18), psychology as the science of the mind had a threefold task: (1) to analyze the sum total of mental processes, identify their elements, and show how they go together; (2) to discover the laws determining the connections between these elements; and (3) to work out in detail the correlations of the mind and nervous system. To accomplish those tasks, psychology must become an experimental science. For Titchener, psychology's experiments consisted exclusively of "an introspection or a series of introspections made under standard conditions" (Titchener, 1902, p. xiii). Titchener's particular brand of introspection is thus the central, indeed the defining, method of his psychology.

Titchener spent the bulk of his career on the first task: determining the elements that make up the structure of the mind; dissecting consciousness; and reducing consciousness to its simplest, most basic elements. Inevitably, Titchener came to describe his approach to psychology as *structuralism.* He used this term for the first time in 1898 in a paper in which he contrasted "The Postulates of Structural Psychology" with the approach of the *functionalists*—psychologists such as Dewey and Angell who opposed elemental conceptions of human experience (Chapter 10). However, neither Titchener nor the functionalists were the first psychologists to use the terms *structural* and *functional.* William James first used these terms in reference to the human mind in 1890 in his *Principles of Psychology* (Chapter 9).

Titchener believed that to study the structure of the mind, psychology must do what all sciences do: start with careful descriptions of its subject matter. Mental processes must therefore be observed, interrogated, and described in terms of observed facts. The observational technique, of course, was introspection—the rigorous, demanding technique of disinterested, experimental self-observation that Titchener had learned from Wundt in Leipzig. In his dedication to psychology as a rigorous experimental science, Titchener constantly emphasized the difficulty of introspection. He reported with approval that in Wundt's laboratory, no observer who had performed less than ten thousand controlled introspections was considered suitable as a source of data for published reports. Titchener strongly implied that at Cornell he would have liked to require *twice* that number. He considered ordinary, commonsense observations worthless, for they were usually inaccurate and almost always involved what he called the "stimulus error"; that is, they were descriptions of the physical event itself rather than of the mental experiences resulting from the event. They were mediate interpretations—"I saw a green light" or "I heard a pleasant tone"—rather than descriptions of the immediate experience *per se.* Furthermore, objective observation is difficult, even for highly trained observers. Children, the insane, and animals were unable to provide such objective introspections and so were excluded from Titchener's "pure" psychology, as were the majority of ordinary adults whose "commonsense introspections" could not be trusted. Titchener also drew a clear distinction between the introspection of his psychological laboratory and the morbid self-absorptions of novelists and essayists (Titchener, 1912, p. 433).

Part of the mystique of science derives from its methods, and Titchener intended the methods of psychology to be as exclusive and demanding as those of any other science. He quoted with approval Thomas Huxley's comment: "There is not one person in a hundred who can describe the commonest occurrence with even an approach to accuracy" (Huxley, quoted by Titchener, 1916, p. 20). But how could one learn to perform correct introspections? Titchener was adamant that no one could learn introspection from books; correct introspections could come only from the laboratory (Titchener, 1901, vol.1, part II, p. xix). Titchener argued that correct introspections could only be made following a long and arduous training under a master observer, often Titchener himself. He was confident that, once gained, the ability to introspect is never lost. With the proper training, introspection becomes so fluent that one is no more likely to forget the ability to introspect than one is to forget how to walk or swim (Titchener, 1901, vol. 1, part II, p. xix). To ensure his students' accuracy in describing their conscious experiences, Titchener drilled them in what he called "hard introspective labor."[2] Certain introspections were defined as correct and certain others as erroneous, with the final authority being Titchener himself. Such a procedure was hardly a satisfactory method for a science. Its weaknesses were soon to become apparent.

But initially the prospects for a rigorous, experimental science of psychology seemed good. A decade later Titchener remained optimistic: "Our graduate students—far better trained, it is true, than we were in our generation—sit down cheerfully to introspective tasks that we had not dreamed of" (Titchener, 1912, p. 427). Washburn described both the appeal of this introspective method and also what she and many other psychologists came to see as its limitations:

> To a person with a liking for chemistry the idea of introspectively analyzing mental states into irreducible elements had attraction, yet one could not forget James' conception of consciousness as a stream and the impossibility that it should be at once a stream and a mosaic. I never followed Titchener when he developed his elaborate, highly refined introspective analysis, and not one of the doctor's theses produced at Cornell and later at Clark [under John Wallace Baird] by the use of this method had any real appeal for me. (Washburn, 1932, p. 343)

To facilitate accurate and correct introspections, Titchener used experiments that allowed systematic introspections to be isolated, varied, and controlled. The experimental methods of psychology were described in the four volumes of his *Experimental Psychology* (1901–1905). The work's subtitle was *A Manual of Laboratory Practice,* and Titchener intended it to be used as a laboratory manual of drill exercises for both students and instructors. He considered most of the instructors of his time unqualified to teach psychology and so wrote two manuals for students and two thicker ones for their teachers. These manuals remained the standard laboratory manuals in psychology for more than thirty years. Oswald Külpe (Chapter 6) is said to have regarded them as "the most erudite psychological works in the English language" (Boring, 1957,

[2] Harriet Rheingold recalled being asked, as a student at Cornell, to use introspection to describe different sensations from silk and satin, while wearing a blindfold. Rheingold found the task frustrating and concluded that it was impossible (Rheingold, 1984).

p. 413). John Watson (Chapter 12) reportedly admitted that he "did not know a great deal of experimental psychology until the manuals fell into my hands" (Wickens, 1980, p. 3), and Boring described them as "encyclopedic and astonishingly accurate" (Boring, 1927, p. 497). Perhaps so, but looking through the books today, one cannot help but wonder how many students and instructors, even in Titchener's time, actually read them. The books do indeed provide rigorous instructions for studying the different senses. Within the sense of vision, for example, demonstrations of color mixing, mapping color sensitivity, visual contrast, and positive and negative afterimages are described with exemplary clarity. But one looks in vain for topics such as learning, memory, motivation, emotion, developmental or clinical psychology. Such omissions are hardly surprising given Titchener's definition of psychology. But also missing in Titchener's manuals are examples of correct introspections.

The Elements of Consciousness

According to Titchener, when immediate experiences are described correctly using introspection, they consist only of sensations, images, and feelings. In his descriptions of the elements of consciousness, Titchener was influenced by the views of the British associationists (Chapter 2). Sensations are the "feels" of our perceptual world; images come from objects that are not physically present—what the British associationists called *ideas*. Both sensations and images, according to Titchener, have particular qualities, the "blueness" of a light, the "highness" of a tone, the "sweetness" of a taste, and so on. These qualities allow us to make distinctions between one sensation or image and another. Sensations and images also differ in their intensity and duration. The task of the experimenter was to describe these qualities using controlled introspections.

The third class of mental elements, according to Titchener, are feelings—the emotional reactions that accompany certain mental experiences. Sensations, images, and feelings were to Titchener the fundamental elements of all mental events. According to Titchener, everything that occurs in consciousness is reducible to these three elements. Complex mental states are always combinations of sensations, ideas and feelings: *attention* results in certain sensations and ideas becoming more vivid and distinct; *meaning* is the product of context—if a particular word is repeated over and over again, it loses its meaning and becomes but a string of auditory sensations. Meaning is what the word had before that loss.

Over the years, Titchener's psychology grew increasingly restricted, becoming more and more a "pure psychology" limited to introspective analysis of the human mind. Titchener had no sympathy for the increasingly applied bent of many of his colleagues. He called the mental tests of James McKeen Cattell, Alfred Binet, and Lewis Terman (Chapter 11) "second-rate and cheap." Ernst Meumann, his former roommate at Leipzig and Wundt's colleague at the Psychological Institute, had pioneered studies of educational psychology, but Titchener dismissed them as "educational technology." Münsterberg's work on industrial problems was an unfortunate example of "trading a science for a technology" (Titchener, 1928). The study of mental illness formed no part of Titchener's psychology, and he often quoted the complaint of H. G. Wells, who in one of his novels said that no sick soul could find help or relief in modern psychology textbooks. Titchener regarded this complaint as a compliment. "Of course they do not," he said, "for psychology in its textbooks is concerned with the normal, human, adult mind, it is not the science of mental comfort and improvement" (Titchener, 1916, p. 2). Reluctantly, Titchener recognized the need for diverse areas of study, but they were not part of his psychology. He grouped together animal psychology, justice psychology, social and ethnic psychology, economic psychology, and even the psychology of plants as somehow impure and less important areas of psychology—impure, it is clear, because their subjects could not engage in introspection. Consider animals. They cannot introspect because they do not use language. Why do they not speak to us? According to Titchener, they do not speak "because they have nothing to say . . . if animals thought, they could undoubtedly use their vocal organs for speech; and since they do not talk, they cannot either be thinking" (Titchener, 1916, p. 267). It seemed to many of his contemporaries that Titchener had excluded most of the interesting and significant areas of psychology, but that did not bother Titchener. His aim was a pure psychology concerned with the study of mental processes using introspection. That others considered his approach restrictive and sterile simply showed how they needed instruction and enlightenment. But Titchener's system could not endure. His introspection was a rigid and limiting method, and more and more psychologists came to regard Titchener's introspection as what one of Wundt's former students, the British psychologist Charles Spearman (1863–1945), described as "a sort of inward staring" (Spearman, 1930, p. 332). Other critics pointed out that:

1. Introspections are always retrospections, with a time period of as much as twenty minutes intervening between the experience and the report. Such delays suggest the possibility of distortion.
2. Introspective reports of consciousness seem remote from consciousness as it is actually experienced. They are dull and irrelevant and certainly not of any functional value.
3. Introspection itself is a conscious process and so must interfere with the consciousness it aims to observe. This sophisticated criticism was derived from Immanuel Kant, who had affirmed that psychological observation by its very nature alters and distorts the state of the observed object. That criticism was difficult to dismiss, and Titchener could only point out that "Kant was not an enthusiast on the subject of psychology" (Titchener, 1912, p. 442). Psychology, however, is not the only field to face this dilemma. In 1927, the physicist Werner Heisenberg (1901–1976) formulated his indeterminacy (uncertainty) principle, which states that the act of measuring one of a pair of physical quantities in a microsystem necessarily destroys the possibility of measuring the other quantity with any degree of accuracy.

In 1912, Knight Dunlap (1875–1949) published "The Case Against Introspection" in the *Psychological Review.* After reviewing the methodological and logical problems associated with introspection, Dunlap concluded that there was "not the slightest evidence for the reality of 'introspection' as the observation of 'consciousness,' and that it is probably better to ban it for the present time from psychological usage" (Dunlap, 1912, p. 412). Challenged by such criticisms, one of Titchener's loyal followers, John Baird, arranged a widely publicized demonstration of correct introspections at the 1913 Yale convention of the American Psychological Association. Seated on a stage in front of the entire convention, Baird's best introspectors from his laboratory at Clark were presented with a variety of carefully controlled stimuli. They proceeded to give dull, meaningless accounts of their sensations, images, and feelings that enlightened no one (Blumenthal, 1985, p. 73). The demonstration was a failure. Many years later, even the loyal Boring was forced to admit that the introspections had not been impressive (Boring, 1953, p. 174). He also conceded that Titchener's instrospection was "not viable and so gradually became extinct" (Boring, 1953a, p. 169).

The Controversial Titchener

The usual portrait of Titchener presented in histories of psychology is one of a powerful, dogmatic personality. It does indeed seem that beneath Titchener's brash, autocratic exterior lay a brash, autocratic interior. Who but Titchener would devote more than half a book review to listing errors the author had made (Titchener, 1922b)? Who but Titchener would refer to the flurry of interest in behaviorism (Chapter 12) and confidently state in 1914:

> The present hullabaloo will quiet down after a few critical papers have made their appearance; and then we shall get our perspective again. I do not belittle behaviorism by hoping that it may soon be set in its right place! But I get a trifle tired of unhistorical enthusiasms. (Titchener, 1914a, in a letter to Robert Yerkes, quoted by Larson & Sullivan, 1965)

In his relationships with psychologists whose views he considered to be in error, and especially with former students who had gone their own way, Titchener could be harsh and unyielding. With those of his fifty-eight Ph.D. students he considered loyal, Titchener was warm and supportive. Perhaps the most loyal of all his students was Boring, who took his Ph.D. with Titchener in 1914. Boring regarded Titchener as brilliant, outspoken, domineering, and the closest to a genius he had ever encountered (Stevens, 1968, p. 591). Boring was so dedicated to his research that, to meet a minor research participation requirement, he studied for four years the regeneration of a nerve in his own forearm, which he had cut in order to trace the return of sensitivity. Years after Titchener's death, Boring wrote the following eulogy for his former teacher:

> Psychology at Cornell—at least the orthodox psychology that centered in the Laboratory—revolved around and was kept in orbit by the personality of E. B. Titchener. What a man! To me he has always seemed the nearest approach to genius of anyone with whom I have been closely associated. I used to watch my conversations with him, hoping that I might gain some insight into why his thinking was so much better than mine. . . . He was always ready with unexpected advice. If you had mushrooms he would tell you how to cook them. If you were buying oak for a new floor he would at once come forward with the advantages of ash. If you were engaged to be married, he would have his certain and insistent advice about the most unexpected aspects of your problems, and, if you were honeymooning, he would write, to remind you, as he did to me, on what day you ought to be back to work. Seldom did he

Boring (Lucy May) and Boring (Edwin Garrigues): A Study in Contrasts

Lucy May Boring (1886–1996) earned her B.A. degree at Mount Holyoke College in 1908, majoring in mathematics but finding more excitement in her psychology classes (Furumoto, 1998, p. 59). Her psychology mentor, Samuel P. Hayes, was a Titchener Ph.D. who encouraged her to study psychology with Titchener. She enrolled at Cornell in 1909 and graduated in 1912, conducting her dissertation research on peripheral color vision. At Cornell she also met her future husband Edwin G. Boring (1886–1968). Edwin Boring studied electrical engineering at Cornell. As one of two electives, he took Titchener's introduction to psychology and was captured both by subject and instructor. When Titchener told him "You have the psychological point of view" Boring's commitment to psychology became definite (Boring, 1952, p. 31). After working briefly as an engineer, Boring returned to Cornell and earned his Ph.D. under Titchener in 1914. Boring's dissertation research was an analysis of the sensations of warmth, cold, pressure, and pains of distortion from the alimentary canal.

The careers of the two Borings stand in stark contrast to each other and offer a poignant illustration of the barriers women faced. Lucy May Boring spent one year after earning her Ph.D. as a graduate assistant at Vassar College and one year as an instructor at Wells College. She published one paper on her dissertation, a report of learning in *paramecia,* and coauthored with her husband a book chapter on time estimation and a paper on masters and pupils among American psychologists (Boring & Boring, 1948). After earning his Ph.D., Edwin Boring was an instructor at Cornell for four years, and from 1918 to 1919 he was the United States Army Chief Psychological Examiner and Research Editor. From 1919 to 1922, Boring was a Professor of Psychology and Director of Psychological Laboratories at Clark University. When financial difficulties at Clark forced

> distinguish between his wisdom and his convictions and he never hid them either. (Boring, 1952, p. 32)

Boring did admit that many of Titchener's able graduate students found his dominance and interference in their lives intolerable. When they rebelled, Titchener excommunicated them, and they found themselves outside his circle. However, Boring and his wife, Lucy Boring, who also earned a doctorate with Titchener, remained faithful to their teacher:

> Quite early in our married life, we decided that we would accept "insults" and arbitrary control from Titchener in order to retain the stimulus and charm of his sometimes paternal and sometimes patronizing friendship. I never broke with the master and I still feel that the credit remained on my side. (Boring, 1952, p. 33)

Ernest Hilgard gave an amusing account of Boring's devotion to Titchener:

> Once Boring was invited to dinner at Titchener's to celebrate Titchener's birthday. After dinner the cigars were passed and Boring could not refuse under the circumstances, though he had never smoked a cigar. The consequence was

Boring (Lucy May) and Boring (Edwin Garrigues): A Study in Contrasts (Continued)

the psychological laboratories to close, Boring moved to Harvard where he spent the rest of his career (1922–1957). Hilgard summarized Boring's contributions to psychology: "Despite a paucity of his own experimental contributions, Boring became an outstanding psychologist because of his critical essays, historical writing, and his editorial and other services as a leader in the psychological profession (Hilgard, 1987, p. 106).

Many of Boring's critical essays were published in the *American Journal of Psychology*, the journal he edited from 1920 until his death in 1968. His *History of Experimental Psychology* (1929) was the text from which a generation of psychologists learned of psychology's past; he was also the first editor of *Contemporary Psychology*. That journal included book reviews that Boring insisted be fair and objective. Boring used his column "CP Speaks" to address issues facing psychology. His columns were often provocative and always lively and well-crafted. With such prominence, Boring was popularly referred to as "Mr. Psychology" (Haynie 1984, p.163). Lucy Boring, looking back on her life in her 97th year, said, "In spite of four children, I managed to keep up my interest in psychology, and read (and advised) every book and article my husband wrote. That I consider my chief contribution" (Furumoto, 1998, p. 59).

Furumoto aptly captures the difference in the careers and contributions of the two Borings: "This striking asymmetry in the career patterns of a husband and a wife with essentially identical training and academic credentials was in keeping with the expectations and practices of the early part of the twentieth century that dictated that middle-class women should chose between marriage and career" (Furumoto, 1998, p. 59). Lucy Boring also illustrates the numerous obstacles women had to overcome to succeed in an academic career (Rossiter, 1982).

> that he had to excuse himself presently because of his nausea and go outside to throw up. Still, the honor of having been invited once was so great that every year thereafter Titchener's birthday would be celebrated by dinner at the Boring home, followed by the smoking of a cigar, with the inevitable consequence. (Hilgard, 1987, p. 106)

To complete our picture of Titchener, we must mention that he was a man of culture, varied interests, and civilized tastes who spoke several languages, was a brilliant conversationalist, and could be surprisingly warm and compassionate. Following the death of Hermann Ebbinghaus, Titchener movingly expressed his deep sense of loss (Chapter 6). He was also one of a very small number of psychologists who stood by Watson during his crisis period and supported him after his dismissal from Johns Hopkins University (Chapter 12).

Titchener's Contributions

Titchener brought a strict empirical approach to psychology. Edward Bissel Holt (1873–1946) described Titchener as "the Dean of American empirical psychology" (Holt, 1911, p. 25). Titchener's *Experimental Psychology* was an important

Experimental Psychologists' Search for Purity

Titchener was one of twenty-six charter members of the American Psychological Association (Chapter 9) in 1892. Twelve years later, in 1904, Titchener became alarmed at what he considered APA's increasingly applied bent. Rather than an organization of experimental psychologists committed to what Titchener considered rigorous research in pure psychology, APA was becoming an organization of mental testers, industrialists, and psychotechnicians. In January 1904, he invited twenty psychologists to an April meeting at Cornell. They were primarily from elite, Eastern universities and were conducting research Titchener considered orthodox and true to his vision of psychology (Furumoto, 1988, p. 95). The group met at Cornell and decided to expand to a maximum of fifty psychologists, the *Experimentalists,* who would have lifetime memberships. In the next twenty-three years they met twenty-three times, with five of the meetings held at Cornell (Benjamin, 1977, p. 726). Titchener controlled the selection of the members and set the meeting agendas to such an extent that the group was often referred to as *Titchener's Experimentalists* (Goodwin, 1985). Titchener insisted that no women qualified for membership. When challenged by Christine Ladd-Franklin, an experimental psychologist who had done important research in color vision and was well-known to Titchener, he was unrelenting (Furumoto, 1992, p. 181). In 1929, after Titchener's death, the group changed its name to the *Society of Experimental Psychology* (SEP) (Pate, 2000, p. 1141). The group still meets every spring. Membership is by invitation and is considered prestigious for an experimental psychologist. Women are no longer excluded.

In 1936, a group of young experimental psychologists in their turn became dissatisfied with SEP. The group's older members for life seemed years from their best research, and the group appeared closed and conservative. The younger psychologists founded the *Psychological Round Table* (PRT) with a membership of no more than forty experimental psychologists who would be forced to resign at the age of forty (Hardcastle, 2000). PRT met each spring for two days devoted to rigorous and free discussion of unpublished research. PRT members considered themselves to be the most creative and active experimental psychologists of their generation. The closely controlled membership

contribution that "helped speed the legitimization of the laboratory as a part of psychological instruction, and thus aided the acceleration of psychology's separation from philosophy. And that, for better or worse, helped make psychology what it is today" (Evans, 1979, p. 3).

Titchener's second major contribution was his role in the development of the *American Journal of Psychology.* G. Stanley Hall founded this journal in 1887 (Chapter 9) and edited it until 1920. Titchener served as Hall's associate editor from 1895 to 1920 and as editor from 1921 to 1925. He resigned suddenly in 1925 and was succeeded by an editorial board that included Madison Bentley, Edwin G. Boring, Karl M. Dallenbach, and Margaret Floy Washburn, all four of whom earned Ph.D.s with Titchener. Titchener's contributions to this journal were voluminous, including major empirical and theoretical reports, minor studies and notes from the Cornell laboratory describing student research, frequent book reviews, restatements and translations of Wundt, comments, and

Experimental Psychologists' Search for Purity (Continued)

was determined by a secret committee of six members. There was no published record of the meetings. With these characteristics, Hardcastle labeled PRT a "cult" in which the experiment was everything (Hardcastle, 2000, p. 344).

PRT members knew their research reports would be rigorously examined in a no-holds-barred atmosphere. Many of them benefited from that examination and considered the PRT meetings highlights of their academic year. The distinguished Stanford experimental psychologist and historian Ernest Hilgard was not a PRT member,[3] but he attended by invitation. He later recalled, "I had the pleasure of attending one of the meetings, and I can attest to both the intellectual excitement and the camaraderie" (Hilgard, 1987 p. 748). Again, however, that camaraderie did *not* extend to women. They were not accepted as members or invited to attend PRT meetings. Two reasons were given for their exclusion: "It was felt that there were no qualified female experimental psychologists in the East and that the presence of women would restrict the often raucous and scatalogical nature of many of the events, especially the social events" (Benjamin, 1997, p. 544).

An example of the latter is evident in the title of the first meeting's banquet address, "The Spontaneous Burrowing Habits of Phallus Domesticus," given by William A. Hunt (Benjamin, 1997, p. 546). The first reason is harder to defend, for there were many women well-qualified for membership. In addition to the women mentioned in this chapter, Eleanor Gibson of Cornell had taken her Ph.D. at Yale with Clark Hull (Chapter 13) in 1938. She was an active investigator of perception. Her "visual cliff" experiments and distinctive-feature theory of perceptual development represent psychological research and theory at its best (Gibson & Walk, 1960; Gibson, 1969). Yet Eleanor Gibson was not invited to membership in PRT. Nor was she able to attend the meetings, not even when they were held at Cornell and hosted by her husband and coresearcher James Gibson. Eleanor Gibson later described PRT as " a very sexist group" (Gibson, 1966). Women have been admitted to PRT since the 1970s.

[3] Because he lived on the West coast, Hilgard was not eligible for membership. A group of PRT members who had moved to the Midwest founded the *Gesellschaft fur Unendliche Versuch* (Society for Unending Research) (GUV) in the late 1950s.

notes and reflections on psychology. In addition to his journal papers, Titchener was also writing books, translating works by Külpe and Wundt, and publishing in other journals, such as *Science* and *Nature.* However, Titchener refused to publish in certain journals because of his feuds with their editors or publishers. The *American Journal of Psychology* cost its owner, Karl Dallenbach, a considerable sum to put out. As expenses mounted, Dallenbach suggested to Titchener that the journal might carry some dignified advertising, perhaps from book publishers or equipment companies. Titchener was so outraged by this proposal that he promptly resigned his editorship (Hilgard, 1987, p. 76). Titchener, in characteristic fashion, tried to start a rival, "pure" journal of psychology, but his efforts came to naught.

Structuralism was the dominant approach to psychology in the United States, but newer, broader, and more flexible movements which grew out of dissatisfaction with Titchener's system soon challenged and then supplanted the structuralist approach. The psychologists who developed the newer approaches had Titchener's system to measure against, with the sure knowledge that Titchener would be quick to point out any weaknesses. Consequently, the new approaches were explicit and well-defined. As Boring wrote in appreciation of Titchener after his death:

> Not only was he unique among American psychologists as a personality and in his scientific attitude, but he was a cardinal point in the national systematic orientation. The clear-cut opposition between behaviorism and its allies, on the one hand, and something else on the other remains clear only when the opposition is between behaviorism and Titchener, mental tests and Titchener, or applied psychology and Titchener. His death, thus, in a sense, creates a classificatory chaos in American systematic psychology. (Boring, 1927, p. 489)

Titchener in Perspective

During the last years of his life, Titchener became increasingly withdrawn and seems to have been a rather sad man. He rejoined APA in 1910, but did not attend APA meetings and was not elected to its presidency. Even when APA met at Cornell in 1925, Titchener did not attend. Instead he held court for selected visitors to his house. Titchener was disappointed not to have been elected a fellow of the Royal Society of London or a member of the National Academy of the United States, and he was never offered the academic position he most desired, a chair of psychology at Oxford. He considered Harvard to be the most prestigious university in the United States, but when in 1917 he was offered a Harvard appointment, he turned it down and remained at Cornell. During the last decade of his life, Titchener withdrew from both university life and psychology. He was rarely seen on the Cornell campus and became something of a legendary figure. Even after his death the Titchener legend and mystique continued, aided in no small part by the display of his brain in the Psychology Department at Cornell.

In the years before his death, psychology was changing in ways Titchener could not accept. *Functionalism* and *behaviorism* became the dominant approaches to psychology. But they were not *his* approach, and Titchener was never convinced that they were even psychologies. In 1925, Madison Bentley (1870–1955), one of Titchener's Ph.D.s, admitted that there were no longer any structuralists (Bentley, 1925, p. 383). Titchener was rumored to be working on a major revision and updating of his psychological system. While occasional sections were published, the book never appeared; it is Titchener's final lost system (Evans, 1972). He devoted most of his time during these years to the study and collection of ancient coins. Thorough as always, he learned Arabic and Chinese to understand those coins (Roback, 1952, p. 188). He became an expert numismatist with a superb collection of coins, but his retreat from psychology is clear. Even at Cornell, Titchener's effect on the subsequent development of the psychology department was relatively small (Ryan, 1982). Bentley succeeded him as head of the department at Cornell and broadened course offerings in psychology to include abnormal, developmental, comparative, legal, and industrial psychology, along with aesthetics and language. Research activities were also considerably broadened under Bentley.

Titchener died from a brain tumor on August 3, 1927, at the age of 60. His psychology had been formed and fixed during his two years with Wundt; perhaps it also was influenced by his perception of himself as an alien in a foreign land whose task it was to instruct and teach. He was never a part of American psychology, but was always Wundt's self-appointed representative at Cornell. Even though Titchener lived in the United States for thirty-five years, he was always an Englishman with all the pleasures of background and accent. Still, he never returned to England, not even for a holiday. By temperament, he at times appeared more German than many Germans, and in fact was occasionally taken to be German, once by an English student. He was, as Keller said, always "an Englishman by birth, a German by temperament, and an American by residence" (Keller, 1937, p. 23).

By the time of Titchener's death, it was clear to all, including Titchener himself, that his *structuralism* had failed. Psychology was changing, and Titchener's inflexible system and rigid approach could not accommodate such changes. Edna Heidbreder summed up the situation:

> If psychology as Titchener interpreted it could not maintain itself in the United States under the leadership of a man of his ability; if, with the prestige of priority and of an honorable academic tradition, it could not establish itself as the basis of future psychology and assimilate future developments to itself—that fact was significant. And to have revealed the fact is no small achievement. (Heidbreder, 1933/1961, p. 148)

In contrast to Titchener, Hugo Münsterberg's approach to psychology was much more compatible with the concerns of contemporary psychologists. His research ideas and many of his findings are being investigated today, and he was a pioneer in developing important areas of applied psychology. For these reasons we will explore in detail the work of Münsterberg, the other of Wundt's European students who emigrated to America.

HUGO MÜNSTERBERG (1863–1916)

Hugo Münsterberg was born in 1863 in Danzig, then part of Prussia but now the Polish city of Gdansk. Danzig was devastated by World War II bombing raids, but in the nineteenth century the city's architecture and location on the Baltic led to its reputation as the Venice of the North. Münsterberg's father was a prominent international lumber merchant—the city of Danzig had been founded centuries before by merchants—and his mother an accomplished artist (Hale, 1980). He was one of four sons and led a happy, almost idyllic life until his mother's death when he was 12. He then changed from being a carefree boy to a serious-minded young man. Münsterberg became a prodigious reader, a writer of epic poetry, a student of archaeology, a reader of Greek and Arabic, the publisher of his school's magazine, a cello player in an amateur orchestra, and an actor in local theatricals, all while attending the local *Gymnasium* and following its rigorous curriculum. Münsterberg's father died in 1880. In 1882, Münsterberg graduated with distinction, joining the elite group qualified to wear the traditional red hat of the *Gymnasium* graduate (M. Münsterberg, 1922).

Hugo Münsterberg.
(Culver Pictures)

After a summer in Geneva and the Swiss Alps, Münsterberg entered the University of Leipzig, planning to study anatomy and physiology to prepare for either medical studies or an academic career in science. In 1883, he attended a course of lectures by Wundt and was deeply impressed (Keller, 1979). He added psychology to his curriculum and worked as a research student in Wundt's laboratory. Wundt assigned him to experiments in which introspection was used to analyze voluntary activities. Münsterberg's introspections convinced him that "will" is not represented in consciousness since the only conscious "will elements" his introspections revealed were sensations from the muscles, tendons, and joints involved in voluntary activities. Later he was to publish an action theory of behavior and consciousness, claiming that muscular sensations were the basis of awareness and consciousness. That view was similar to a theory of emotion which the American psychologist William James had just published (James, 1884). But Wundt found Münsterberg's views incompatible with his own theory of consciousness, so he rejected Münsterberg's findings as being due to his inexperience. Wundt then set him to work on "simpler tasks" (Keller, 1979). This was the first of a number of stresses and tensions between the two men. However, Münsterberg was able to complete his Ph.D. under Wundt. His 1885 dissertation, "The Doctrine of Natural Adaptation," was a nonexperimental, critical examination of that biological doctrine. He then transferred to the University of Heidelberg and received an M.D. degree in 1887, writing a thesis on the visual perception of space. Münsterberg later recommended taking both degrees as the ideal preparation for an applied career in psychology.

Münsterberg's Early Academic Career

In 1887, Münsterberg was appointed *Privatdozent* at the University of Freiburg under the familiar conditions of no regular salary but a small income from fees students would pay while taking his courses. In 1888, Münsterberg published a small book, *Activity of the Will,* in which he returned to his earlier interest in will and voluntary activities. He restated the position he had formulated while working in Wundt's laboratory and once again faced attack and criticism from his former teacher, this time in public. Titchener joined in the criticism, describing Münsterberg's experiments as inexact and incomplete. In characteristic fashion, Titchener concluded that "Dr. Münsterberg has the fatal gift of writing easily—fatal especially in science, and most of all in a young science, where accuracy is the one thing most needful" (Titchener, 1891, p. 594). A much more positive reaction came from William James, who saw the book as supporting his theory of emotion, the James-Lange theory (Chapter 9). In his *Principles of Psychology,* James referred to the book as "a little masterpiece" (James, 1890, vol. 2, p. 505). James arranged to meet the young man at the First International Congress of Psychology in Paris in 1889 and was impressed by him.

At the University of Freiburg, Münsterberg established Germany's second psychological laboratory. Initially it was nothing more than a couple of rooms in his house fitted with apparatus purchased from his own funds (Hale, 1980), but the laboratory was very productive. Münsterberg published a series of *Contributions to Experimental Psychology* (1889–1892), which again drew criticism from Wundt and Titchener but were well-received by James. In his Principles, James refers to Münsterberg's "beautiful examples of experiments on reaction time" (1890, vol. 1, p. 432) and "masterly experiments on time perception" (1890, vol. 1, p. 620). In 1891, Münsterberg's laboratory was moved to the university. James arranged for one of his students, Edwin B. Delabarre, to work there. Delabarre's reports of exciting research confirmed James's opinion that Münsterberg was a promising young man. Münsterberg's work also provided a welcome alternative to the psychology and writings of Wundt and the assertive Titchener.

As we will see in Chapter 9, by 1892 James had decided to give up experimental work so that he could devote more time to his philosophical writings and lectures. At the time, the following psychological laboratories had been established in the United States:

University	Date Founded	Founder
Johns Hopkins	1883	G. Stanley Hall
Indiana	1887	William Lowe Bryan
Pennsylvania	1887	James McKeen Cattell
Wisconsin	1888	Joseph Jastrow
Clark	1889	Edmund Clark Sanford
Kansas	1889	Olin Templin
Nebraska	1889	Harry Kirke Wolfe
Columbia	1890	James McKeen Cattell
Iowa	1890	George T.W. Patrick
Michigan	1890	James Haydon Tufts
Catholic	1891	Edward Pace
Cornell	1891	Frank Angell
Wellesley College	1891	Mary Whiton Calkins

(Benjamin, 2000, p. 319)

Harvard is notably absent from this list. James, as an article of faith, believed that Harvard's laboratory should be the best. He needed a young man of vision to direct Harvard's laboratory and provide leadership for American psychology. Münsterberg was an obvious choice. In February 1892, James wrote to him:

> Dear Dr. Münsterberg,
>
> Is it conceivable that if you should be invited, you might agree to come and take charge of the Psychological Laboratory and the higher instruction in that subject in Harvard University for three years at a salary of say, 3,000 dollars?

After this characteristic opening, James forthrightly described the background to his offer:

> We are the best university in America, and we must lead in psychology. I, at the age of 50, disliking laboratory work naturally, and accustomed to teach philosophy at large, altho I could *tant bien que mal* [for better or worse], make the laboratory run, yet am certainly not the kind of stuff to make a first-rate director thereof. We could get younger men here who would be safe enough, but we need something more than a safe man, we need a man of genius if possible. (Letter quoted in M. Münsterberg, 1922, p. 33)

As additional inducements, James mentioned that after three years it might be possible to arrange a permanent Harvard appointment. A sum of $1,600 would be immediately available for the laboratory, with further support promised; two research assistants would work in the laboratory; and Münsterberg's maximum teaching load would be less than six hours a week. This offer of a three-year trial appointment as director of the Harvard psychology laboratory to a man still in his twenties was remarkable. It reflects both James's prestige and also his confidence in Münsterberg. It also seems likely that a less elevated motive was to provide a Harvard alternative to Titchener's Cornell laboratory. But Münsterberg hesitated. He had a deep love for his German homeland, was unsure about life in America, could read but not speak or understand English, and was confident of progressing within the German university system. However, after numerous letters of encouragement and a personal visit from James, Münsterberg accepted the position and sailed for America in August 1892. James was delighted and described his appointment as "the best stroke I ever did for our University" (Hale, 1980, p. 48).[4] Arriving in Boston by train, he was met by the eminent Harvard philosopher Josiah Royce.

During his first three years at Harvard, Münsterberg, whose English was poor and who lacked confidence in his ability to speak and write the new language, was content to concentrate on laboratory work and publish his results in German. However, by 1894 he was able to give his inaugural lecture at Radcliffe College, and in 1895 to debate G. Stanley Hall (Chapter 9) before the Boston Schoolmasters' Club on the place of psychology in education. He argued that

[4] Münsterberg's loyalty to James showed when Witmer (Chapter 8) published a critical commentary on James's work with mediums and his interest in spiritualism. Münsterberg was incensed and declared that planned APA meetings would not be held at Harvard unless Witmer was expelled (Landy, 1997). James intervened, recommending to Münsterberg that he be less sensitive and stressing his friendship with his fellow student at Leipzig. APA met at Harvard as planned (McReynolds, 1997b).

psychology had no relevance to education, a position he was to change in later years as he advocated the presence of psychologists in the schools (Hale, 1980). His three-year trial period was a success. James enthusiastically described the Harvard laboratory as “a bower of delight” while the more objective Cattell acknowledged that Münsterberg’s Harvard laboratory was “the most important in America” (Hale, 1980, p. 49). Both James and Harvard president Charles W. Eliot encouraged him to stay, but in 1895 Münsterberg returned to the University of Freiburg. He clearly hoped to stay in Germany, but because of a combination of political pressure, academic infighting and anti-Semitism, he was unable to secure a satisfactory position at a German university (Hale, 1980, p. 53). He returned to Harvard in 1897, consoled by Wundt, who reminded him “But after all, America is not the end of the world” (Hale, 1980, p. 55).

At Harvard, Münsterberg wrote his first major book, published in German in 1900, the *Grundzüge der Psychologie* (Principles of Psychology). The book was very much a reflection of his German training, but already Münsterberg was being influenced by his American experiences, especially teaching Harvard’s first introductory course on psychology (Fuchs, 2000, p. 492). The work was dedicated to William James, and from that time on Münsterberg always “looked at the American world through German eyes with Harvard astigmatism” (M. Münsterberg, 1922, p. 326). In 1901, he published his first major book in English, *American Traits,* and from that time was a prolific author, writing more than twenty books in English, six in German, and literally hundreds of journal, magazine, and newspaper articles (Viney, Michaels, & Ganong, 1981). Münsterberg was a gifted writer of books that often appealed to the general public. He was also a very fast writer, able to compose a book in less than a month. However, most of his writings were dictated, and Münsterberg cheerfully admitted that his secretary actually did the physical writing.

In a provocative analysis, Frank Landy (1992) suggests that Münsterberg’s writing style may have contributed to his later difficulties and his enigmatic scientific reputation:

1. His first major work in English was pummeled by a critic in the British journal *Mind.* Characteristically, Münsterberg overreacted and vowed never to write another serious work in English. Though he did not keep his vow, much of his work was only available to English-speaking psychologists in translation.
2. Münsterberg published often in *Harper’s, The Atlantic Monthly,* and the *New York Times.* While those were serious publications with large readerships, they were not part of the scholarly and research literature of psychology.
3. He often repeated himself in books and lectures. On occasion he ignored the contributions of others while claiming too much credit for himself.
4. He seldom published complete data or detailed analyses of his results, though in some cases such data may have existed (Burtt, 1917). Their absence lowered the quality and validity of his publications.

Münsterberg’s Applied Psychology

Münsterberg always intended his psychology to be as broad and inclusive as possible. He had no patience with restrictive approaches such as Titchener’s.

He often dismissed Titchener's *structuralism* as precise but not useful (Landy, 1992, p. 788). In fact, Münsterberg consistently refused to give a precise definition of psychology since any definition would imply restrictions he did not intend and could not accept. He was interested in such functions as understanding, memory, learning, empathy, and such acts as the search for beauty, love, and faith. His was a purpose-oriented functionalist psychology. For Münsterberg, it was "more natural to drink the water than to analyze it in the laboratory into its chemical elements" (Münsterberg, 1914, p. 14). His lifetime interest was in the application of psychological knowledge in the service of humanity, and it is these applications that we will now consider. However, it is important to remember that Münsterberg always considered himself an experimental psychologist. Later he was to refer to patients coming for treatment to his "laboratory" and to his "experiments" in industrial settings.

Münsterberg's Clinical Psychology

Münsterberg long had an interest in mental illness. He began to see patients in Germany and continued to do so in the United States. He was an unusual clinician. Rather than establishing a clinic, Münsterberg met his patients in his laboratory. He accepted only patients who were of scientific interest; of the many hundreds of people he treated, not one paid a fee (Münsterberg, 1909, p. ix). He believed that mental illness always has a physiological basis and so opposed general or schematic approaches to treatment. First he made a diagnosis based on his observations of the patient's behavior, an interview, the patient's answers to his questions, and often the patient's responses to a word-association test. If he concluded that the case was of scientific interest and that the patient was not psychotic, he would provide treatment. Münsterberg's approach was directive. He saw himself as the purposeful agent of therapy and sought to impose his will on the patient. He used direct suggestions and autosuggestions and encouraged the patient to "expect" to get better. Münsterberg thought that for patients "to lie down on a lounge on which hundreds have been cured fascinates the imagination sufficiently to give every suggestion a much better chance to overcome the counteridea" (Münsterberg, 1909, p. 222). Münsterberg also relied heavily on assurance. The therapist assures the patient that, for example, the patient will sleep that night, and the next day when they meet remarks how well-rested the person appears. What Münsterberg termed *reciprocal antagonism* was used to overcome troublesome ideas or impulses. The opposite idea or impulse was "reinforced" to block expression of the undesirable one (Münsterberg, 1909, p. 218). Finally, Münsterberg used hypnosis, but in a conservative and guarded manner. He found that it was especially useful in facilitating receptivity to suggestions. His aim was direct relief of symptoms, not deep changes in the patient's personality. In an early publication, Münsterberg had sought to allay fears of hypnosis and of the belief in the evil eye. He stressed the beneficial effects of hypnosis in the hands of a skilled practitioner (Münsterberg, 1910).

Münsterberg reported success with these clinical techniques in the treatment of a wide range of problems: alcoholism, drug addiction, hallucinations, obsessions, phobias, and sexual disorders. These outcomes and procedures were described in his book *Psychotherapy*, written in six weeks and published in 1909. He defined psychiatry as the "treatment of mental diseases" and described psychotherapy as the "practice of treating the sick by influencing the mental life" (Münsterberg, 1909, p. 1). As such, psychotherapy was but one of the approaches available to the psychiatrist and was not appropriate for certain types of mental disease—for example, psychoses and diseases due to deterioration of the nervous system. The dominant voice in psychiatry at the time was that of Sigmund Freud (Chapter 8). Münsterberg, while seeing the value of Freud's emphasis on the traumatic origin of some hysterical symptoms and the sexual basis of many neurotic disorders, did not accept Freud's views on the importance of unconscious determinants. According to Münsterberg, "the story of the subconscious mind can be told in three words: there is none" (Münsterberg, 1909, p. 125). On occasion, though, he did appeal to unconscious explanations of behavior and even recommended psychoanalysis. One especially ill-judged recommendation followed a luncheon at the White House with President Taft and his wife. Münsterberg wrote to the president that he had noticed that Mrs.Taft had been drinking whiskey. He assumed that the whiskey had been prescribed for an emotional problem. Münsterberg suggested to the President that his wife's problem might lie in repressed impulses and recommended that she consult a psychologist (Landy, 1992, p. 793).

Psychotherapy was written for a general audience and was intended to counter half-truths and false information surrounding mental illness. The book was well-received and sold 3,000 copies in two months. In three years it went through five printings and continued to be successful for many years. Münsterberg's clinical work did, however, produce one unfortunate episode. One of his female patients developed a paranoid delusion centered on him and threatened him with a gun as he was leaving a lecture. Fortunately, nobody was injured, but the resulting legal actions and publicity led President Eliot of Harvard to advise Münsterberg to forgo the hypnotic treatment of women. Münsterberg agreed, though he did continue his experimental research on abnormal behavior.

In one series of experiments, Münsterberg sought conditions under which a second personality, often seen in hysterical patients, might emerge in normal people. He hoped that such a personality might influence certain automatic actions, and so he performed a number of automatic writing experiments. In these experiments, a subject would actively attend to an interesting story while holding a pencil on a blank page. Some subjects would write down some of the words they heard, but in an unconscious and involuntary manner. Münsterberg believed that these words were a reflection of the person's second personality. After some practice, a number of subjects, including Gertrude Stein, who was then a student at Radcliffe College, were able to focus their attention on a word four or five words behind the one actually being written. B. F. Skinner (1934/1959) described these automatic writing experiments of Münsterberg and Gertrude Stein's role as a subject. Skinner argued that evidence of automatic writing can be seen in Stein's later literary works and that this writing might have been a reflection of her second personality.

The Beginning of Forensic Psychology

Beginning in 1908, Münsterberg wrote numerous articles on the application of psychological information in legal situations—forensic psychology. The great interest expressed in these articles and his own experiences observing a number of criminal trials led him to write a best-selling book, *On the Witness Stand,* published in 1908. The book went through numerous printings in both the United States and England, the most recent being in 1976. In the introduction, Münsterberg set the stage for this application of psychology:

> There are about fifty psychological laboratories in the United States alone. The average educated man has not hitherto noticed this. If he chances to hear of such places, he fancies that they serve for mental healing, or telepathic mysteries, or spiritistic performances. What else can a laboratory have to do with the mind? Has not the soul been for two hundred years the domain of the philosopher? What has psychology to do with electric batteries and intricate machines? Too often I have read such questions in the faces of visiting friends who came to the Harvard Psychological Laboratory in Emerson Hall and found with surprise twenty-seven rooms overspun with electric wires and filled with chronoscopes and kymographs and tachistoscopes and ergographs and a mechanic busy at his work. (Münsterberg, 1908, p. 3)

In this passage, we see Münsterberg's characteristic delight in the mechanics and brass instruments of psychology as a laboratory science.[5] While his own interests became increasingly applied, his first love remained the Harvard laboratory. He saw to it that the laboratory's work continued under Edwin Bissel Holt (1873–1946) for human research and Robert Mearns Yerkes (Chapter 11) for animal research. One of his students, Herbert S. Langfeld, succeeded him as director of the laboratory.

In a fascinating chapter in *On the Witness Stand,* Münsterberg described eyewitness reports and the many psychological reasons for disagreements between equally trustworthy witnesses trying their best to give accurate and truthful testimony. Why does such testimony so often differ? Münsterberg explained the difference between subjective and objective truth: an oath to "tell the truth, the whole truth, and nothing but the truth" is in fact no guarantee of objective truth. Münsterberg described illusions to demonstrate how our senses can be deceived and showed how suggestions affect our perceptions. He pointed out that memories are often unreliable, especially when we try to recall events from some time past. When a burglar broke into his house, Münsterberg testified at the trial that the man had entered his house by a window, only to find that he had actually entered by a cellar door. Even with the best of intentions, ideal conditions, and a short time span between an event and its recall, memories are often unreliable. To illustrate this, Münsterberg described a demonstration originally done at the University of Berlin:

> A few years ago, a painful scene occurred in Berlin, in the University Seminary of Professor von Liszt, a famous criminologist. The Professor had spoken about a book. One of the older students suddenly shouts, "I wanted to throw light on

[5] An instructive and beautiful illustration of the central place of apparatus in psychology is seen in *The Great Catalog of the C. H. Stoelting Company* (Popplestone & Tweney, 1997).

Contemporary Research on Eyewitness Testimony

Groundbreaking contemporary research by Robert Buckhout (1974) and Elizabeth Loftus (1979) on eyewitness testimony was both methodologically sound and theoretically provocative (Yarmey, 1979). By 1995, over 2,000 publications existed on the reliability of eyewitness testimony (Cutler & Penrod, 1995). In 1999, the United States Department of Justice released *Eyewitness Evidence: A Guide for Law Enforcement,* national guidelines for the collection and preservation of eyewitness evidence in criminal cases (Wells et al., 2000). Psychologists were instrumental in the successful application of laboratory eyewitness research. At times, psychologists who testify in court on this topic find their authority and expertise challenged (Loftus & Ketcham, 1992). Yet in May, 2001, the highest court of the state of New York noted that expert testimony on the unreliability of eyewitness reports *could* be admitted at trial (McKinley, 2001).

Münsterberg's role as a pioneer in this application of psychology is clear. In a survey of nine leading contemporary eyewitness researchers, Kinlen and Henley found:

> . . . an almost universal respect for Münsterberg's ideas and specific contributions to forensic psychology, and surprisingly that most did not encounter his major contributions to the area (e.g., *On the Witness Stand*) until after they had become involved in the field. (Kinlen & Henley, 1997, p. 70)

> the matter from the standpoint of Christian morality!" Another student throws in, "I cannot stand that!" The first starts up, exclaiming, "You have insulted me!" The second clenches his fist and cries, "If you say another word. . . . " The first draws a revolver. The second rushes madly upon him. The Professor steps between them and, as he grasps the man's arm, the revolver goes off. General uproar. (Münsterberg, 1908, pp. 49–50)

The whole incident, in fact, had been staged. Once order was restored, the students were asked to write an account of what had happened. Their accounts were dramatically different. Münsterberg staged a number of these "uproarious scenes" or "reality experiments" before audiences of lawyers and psychologists to demonstrate that our memories are often unreliable. When we are asked to recall events some time later, especially under the stressful conditions of courtroom testimony and with competing lawyers asking leading questions, inaccuracies are to be expected. Münsterberg scorned the adversary legal system, which he regarded as a museum of irrational procedures. He castigated the obdurate legal profession and the obstinacy of lawyers in not accepting the findings of psychology. Predictably, his intemperate language led to an explosive response from the legal profession. *On the Witness Stand* was denounced as "yellow psychology," and Münsterberg was lambasted for his presumption in making such recommendations (In Loh, 1981, p. 662). John Wigmore, a legal scholar, wrote a merciless satire in which a legal suit is brought against Münsterberg by the legal profession for injury to its good name (Wigmore, 1909). Wigmore concluded that Münsterberg had capriciously sought to injure the good name of lawyers and that psychology had nothing to offer the law. Lawyers were also able to cite Titchener, who had disparaged Münsterberg as an opportunist and his legal work as a misapplication of psychology (Titchener, 1914b, p. 51). So intense was the reaction that American psychologists left the law alone and forensic psychology was stillborn (Hutchins, 1927). Remarkably, a hiatus of some seventy years followed before psychologists returned to the topic of eyewitness testimony.

In *On the Witness Stand,* Münsterberg included a chapter on crime prevention. Münsterberg believed that criminals are made, not born; society creates the conditions that foster and produce crime. Consequently, such conditions must be changed. Münsterberg retained an interest in crime and legal affairs to the end of his life. Unfortunately, the press sensationalized much of his work, and Münsterberg became a controversial public figure.

The Sensational Münsterberg

Another section of *On the Witness Stand* deals with the detection of crime. Münsterberg condemned brutal, third-degree methods of interrogation. According to him, psychological alternatives should replace such barbaric methods. To detect whether a person was lying, Münsterberg used a variation of the reaction-time technique in laboratory experiments. He also had an opportunity to use his techniques in the real-world setting of the sensational trial of Harry Orchard. Orchard was the self-confessed murderer of eighteen people, including a former governor of Idaho. He accused leaders of the Western Federation of Miners, including the union's president, Big Bill Haywood, of having directed and paid for the murders. The governor had been an opponent and critic of organized labor. Orchard was a witness for the prosecution at the trial of the union members. Orchard's credibility, which was crucial, was apparently buttressed by his claim that he had converted to the Seventh Day Adventists and thus made his peace with God. The new governor of Idaho invited Münsterberg to attend the trial in Boise and to test Orchard. In the courtroom Münsterberg's first impressions of the man were highly unfavorable. He had a "brutal, vulgar, murderous profile" and seemed far from the religious convert he claimed to be. Münsterberg resolved, however, "not to consult his antipathies, but rather to rely on his experiments" (Münsterberg, 1908, p. 94).

In his initial interview with Orchard, Münsterberg sought to impress him with his scientific powers. First Münsterberg made a five-cent piece disappear by moving it through the blind spot in Orchard's visual field; then he showed him a number of perceptual illusions and distortions. When Münsterberg judged Orchard to have been sufficiently impressed, he recited a list of fifty words to him and asked him to respond to each word with the first word that came to mind. Münsterberg recorded for each stimulus word the latency of Orchard's reaction. Included in the list were a few words relating to the crimes—"revolver," "blood," and "pardon"—and to Orchard's professed religious conversion. Orchard's reaction times for the "dangerous" words were no different from his reaction times for the other words. Münsterberg stayed in Boise for four days, attending the trial, meeting with Orchard, and conducting his tests. He concluded that the man was not trying to hide anything, that his conversion was sincere, and that, subjectively at least, he was telling the truth. Münsterberg's daughter described what happened next:

> On his way home the exhausted Münsterberg met a newspaper reporter and in an unguarded moment let slip his conclusion that he believed that Orchard was telling the truth. Banner newspaper headlines proclaimed Münsterberg's "verdict," and he was censured by the press for interfering in the trial, even though the jury was sequestered from the flood of sensational publicity. Absurd accounts of the techniques he had used in his interviews with Orchard appeared in the press. One California newspaper asserted that Münsterberg had performed a phrenological analysis of the thickness and dimensions of Orchard's skull. The reporter ended his account with the witticism "I'll bet a dollar to two bits that Professor Münsterberg has a head like a prize pumpkin." (M. Münsterberg, 1922, p. 147)

In *On the Witness Stand,* Münsterberg also discussed untrue confessions—when people claim to have committed crimes they actually have not committed. He warned against accepting such confessions; once again, the warning was based on an unfortunate experience with the press. Richard Ivens, an apparently retarded young Chicagoan suspected of the brutal murder of a young housewife, confessed to the crime after intensive police questioning. Later he retracted the confession and established an alibi, but he still was tried and convicted. A Chicago neurologist, J. Sanderson Christison, described the case to Münsterberg and asked his opinion of the outcome. In a private letter, Münsterberg replied that he felt sure that the man was innocent, that his confession was untrue, and that he had been unjustly convicted. Christison published Münsterberg's letter, which caused a sensation. Headlines referred to Münsterberg as "Harvard's Contempt of Court." Ivens's sentence was upheld, and with record crowds outside the jail, he was executed. Münsterberg was convinced that a terrible injustice had taken place.

Münsterberg also discussed the conditions under which untrue confessions are likely to occur: intense and prolonged interrogation of people who have a need to please, people who need to comply with powerful authority figures, or deeply depressed people who feel they deserve punishment. Münsterberg discussed the Ivens case in detail, describing the conditions under which the man had made his confession and the suspicious fact that more and more damning details of the crime had been given by the suspect during interrogation.

In 1914, Münsterberg published an article, "The Mind of the Juryman," in which he described experiments he had done at Harvard on group decision making. Students were required to make a judgment alone and then were given the opportunity to discuss the judgment with others before making a second one. When students made judgments alone, 52 percent were correct; when they made judgments in a group, 78 percent were correct. Münsterberg concluded that the jury system of group decision making is a psychologically sound procedure. Unfortunately, even this experiment led to controversy, for when Münsterberg repeated the experiment with female students at Radcliffe College, he found no increase in the percentage of correct decisions after the discussion. He concluded that women are not capable of rational discussion in groups and that the jury system would work well as long as women did not serve. That conclusion led to a flood of sensational newspaper headlines and a heated challenge from Boston's women lawyers (M. Münsterberg, 1922, p. 435). Despite this unfortunate controversy, Münsterberg's experiment was a pioneer study

Lies, Blood Pressure, and Wonder Woman

Münsterberg was confident that eye movements, respiration, heart rate, blood pressure, hand tremor, and the electrical resistance of the skin could measure lying and deception. He had no doubt that even in criminal cases "experimental psychology can furnish amply everything which the court demands" (Münsterberg, 1908, p. 131). Rumors spread that he had developed a marvelous lying machine or truth detector, but there never was any such machine in his laboratory. One of Münsterberg's Harvard students, William Moulton Marston, claimed to have discovered a specific lie response, an increase in systolic blood pressure. In his popular book *The Lie Detector Test,* Marston wrote that measurement of the lie response "marked the end of man's long, futile striving for a means of distinguishing truth telling from deception" (Marston, 1938, p. 45). This grandiose claim was based upon Marston's use of an ordinary medical sphygmomanometer to take periodic measures of blood pressure during an interview or examination.

Marston was an avid self-publicizer. He offered to test Bruno Hauptmann, the man accused of kidnapping and murdering the Lindbergh baby, but his offer was rejected. Marston believed that his measurements could also be used in marital counseling; a wife's reaction to her husband's kiss could be compared with her response to the kiss of an attractive stranger! Advertisements for Marston's machine and descriptions of his services appeared in full-page magazine advertisements.

In Chicago in 1921, John A. Larson constructed a machine which continuously measured blood pressure, pulse rate, and respiration—the first polygraph. He also made a careful study of the accuracy of measures of deception using polygraph records. Larson concluded that there was no detectable lie response and later described the burgeoning field of polygraphy and lie detection as little more than a racket (Larson, 1938). In a scathing review of Marston's book, Fred E. Inbau, a professor of law at Northwestern University and former director of the Chicago police scientific crime detection laboratory, concluded that such a work "can only bring ridicule upon the subject matter and disrespect for its author" (Inbau, cited by Lykken, 1981, p. 28).

of group decision making and has been cited as a cornerstone of the experimental study of group psychology (Murphy & Kovach, 1972).

While Münsterberg's work as a psychotherapist and forensic psychologist was important in the broadening of psychology and was at times controversial, he is most important in the history of psychology for his work as an industrial psychologist.

The Beginning of Industrial Psychology

Münsterberg is often considered to be America's first industrial psychologist, with *Psychology and Industrial Effciency*, published in 1913, the work in which "Münsterberg presented the first systematic formulations of the problems and scope of industrial psychology" (Viteles, 1932, p. vii). The book is divided into three main sections. The first section, on worker selection, includes nine chap-

Lies, Blood Pressure, and Wonder Woman (Continued)

An even more serious challenge came from the courts. The case was *Frye vs. the United States* (1923). In November, 1920, a young black man, James Frye, was arrested in Washington D.C. for the murder of a prominent white physician. After several days of police interrogation, he confessed to the murder. Just days before his trial, Frye repudiated his confession, claiming he had been coerced by a promise of half the $1,000 reward should he confess. Marston administered his blood pressure test to Frye and concluded that he was innocent. The defense petitioned for Marston to be qualified as an expert witness and his results accepted as evidence. The presiding judge, however, ruled to exclude the lie detection evidence as it was not based upon a well-recognized and established scientific principle. Higher courts upheld his ruling, and for fifty years lie detector evidence was excluded from American courts.

The court's decision finds support in recent research. David Lykken has been a vigorous critic of lie detection and polygraphs (Lykken, 1979; 1981). In 1983, the United States Congress Office of Technology Assessment raised serious questions about the accuracy of polygraph testing (OTA, 1983; Saxe, Dougherty, & Cross, 1985). Iacono and Patrick (1988) found that 45 percent of innocent suspects were erroneously diagnosed as deceptive. In 1988, the United States Congress banned the use of the polygraph in most employment settings.

What then of William Marston? He gave up lie detection and left psychology. With his wife Elizabeth Holloway Marston, also a psychologist, he developed a successful cartoon character, Wonder Woman:

> Wonder Woman was created in the Marstons' suburban study as a crusading Boston career woman disguised as Diana Prince, who would dash into a ladies' room (the lines were shorter in those days) and emerge in her eagle-festooned, red-white-and-blue crime-fighting culottes. As powerful as a man and as loving as a woman, she was also properly patriotic. (Malcolm, 1992)

For fifty years in more than 600 episodes and then in a TV series, evil-doers caught by Wonder Woman's Lasso of Truth were forced to look into their own hearts and tell the truth. They could not lie!

ters on "the best possible man for the job,"—as was typical of his time, it never seems to have occurred to Münsterberg that women, too, might want to work. The next six chapters discuss "the best possible work," or factors affecting worker efficiency; and the final six chapters are on "the best possible effect," which deal with marketing, sales, and advertising techniques.

For a company to select the best possible workers, Münsterberg recommended that self-report measures of vocational interest be supplemented with "tasks in miniature," which assess an individual's capacity for a particular job and predict later performance. Münsterberg believed that for many industrial and occupational tasks it is possible to "miniaturize" the situation in which the potential employee will be working, to develop what today would be called simulations. In these simulated work situations, potential workers' abilities can be assessed. As an example of such an approach, Münsterberg cited work he was asked to do in 1912 for representatives from a number of cities that had elevated or street-level railways. The representatives were concerned about the psychological factors involved in accidents on street railways. Münsterberg decided that the performance abilities of the driver or motorman were crucial. Drivers needed continuous attention, quick reactions, and the ability to anticipate the future actions of pedestrians and other vehicles in order to avoid accidents. Münsterberg developed a game or simulation in which the participant had to make a series of decisions and reactions in situations similar to those he would encounter while driving a train through busy city streets: a pedestrian, animal, or vehicle suddenly crosses the tracks; a brake malfunctions; and so on. Münsterberg worked with three groups of employees from the Boston Street Railways Company: twenty-year veteran motormen with excellent records, men who had barely escaped dismissal and had been involved in frequent collisions, and men with average service records. On a simple reaction-time test, Münsterberg found no consistent differences among the three groups. When tested using the game or simulation, many of the men reported that they really had the feeling of driving a train. There were, however, consistent differences in performance among the three groups; the group with good records consistently did better than the men who had been close to dismissal. Münsterberg was convinced that the test could be used as a selection procedure and that many men who might go on to present high accident risks could be identified and selected out. He also did some preliminary work for a number of shipping companies and the United States Navy on the development of selection procedures for ships' officers. Münsterberg believed that similar selection procedures could be developed for a variety of other occupations.

As a second example of the way in which psychology might contribute to employee selection, Münsterberg presented his work for the New England Telephone Company. The company found that among the young women successfully trained as telephone operators, one-third were not able to perform well on the job and either left or were dismissed within six months. Münsterberg began by observing the operators' work situation. They averaged 225 calls per hour, but at peak periods often handled as many as 300. He estimated that fourteen separate "psychological processes" were involved in answering the typical call, especially memory, attention to detail, exactitude, rapidity, and general intelligence. Münsterberg developed a series of tests for these psychological functions. In the memory tests, operators were asked to repeat two four-digit numbers; then additional digits were added, to a maximum of twelve. In the attention test, they were told to cross out all the examples of a particular letter on a newspaper page; in the test of exactitude, the edges of a sheet of paper had to be divided into two equal halves; in a test of rapidity, the operators drew as many specific zigzag movements as possible during ten seconds. In another ingenious test, paced by a metronome, examinees had to hit scattered points on a paper representing the connections an operator had to make on a switchboard.

Münsterberg gave these tests and one general intelligence test to a group he was told consisted of newly hired employees. He compared the test results with their actual work performance during their first three months of employment. Actually, most of the people tested *were* newly hired employees, but unknown to Münsterberg, the telephone company had included in the group a number of highly experienced operators (ringers!) with excellent work records. Münsterberg described the outcome of the testing as follows:

> If the psychological experiments had brought the result that these individuals who stood so high in the estimation of the telephone company ranked low in the laboratory experiment, it would have reflected strongly on the reliability of the laboratory method. The results showed, on the contrary, that these women who had proved most able in practical service stood at the top of our list. Correspondingly, those who stood lowest in our psychological rank list had in the meantime been found unfit in practical service and had either left the company of their own accord or else had been eliminated. (Münsterberg, 1913, pp. 108–109)

The agreement of test results and work performance was not perfect, but the method held promise.

With regard to improvement of worker efficiency, Münsterberg had much less empirical information to present. He had studied work conditions at the General Electric and International Harvester companies, the Plimpton Press, the Waltham Watch Company, and a number of other companies. Münsterberg did not agree with a common view that much modern industrial work is characterized by dreadful monotony and mental starvation. In the factories and plants he visited, he made a point of chatting with the workers whose jobs appeared to be the most tedious and monotonous. Often the workers did not describe their jobs in these terms and were content with their work. In one dramatic case, Münsterberg observed a woman in an electric lamp factory whose job was to wrap lamps in tissue paper—13,000 units per day. She had done the job for twelve years, and Münsterberg estimated that she had wrapped 50 million lamps. Yet she assured him that the work was "really interesting" and said that she found "constant variation" in the way she wrapped each lamp (Münsterberg, 1913, p. 196). Münsterberg concluded that the judgments of outsiders as to which tasks breed boredom and frustration were unreliable and that many of the so-called higher professions involved a great deal of tedious repetition: the work of physicians, teachers, and lawyers is far from free of monotony. Münsterberg concluded that many factors affect worker satisfaction and morale and that many more investigations were needed.

In the last section of his book on industrial psychology, Münsterberg discussed factors that stimulate consumer demand and ways in which advertising effectiveness can be increased. In his laboratory, Münsterberg investigated the effects of the size and number of repetitions of an advertisement on its "memory value." He was convinced that advertising could be a powerful factor in stimulating product demand but also believed that it must be used responsibly. In a later article, "The Social Sins of Advertising," Münsterberg bitterly attacked as socially irresponsible the new practice of scattering advertisements throughout the texts of magazines and newspapers rather than, as had formerly been done, segregating them in one section. Debate over the appropriate placement of advertisements continues today with respect to television commercials. In the United States, they are scattered throughout a program; in England, on the commercial channel of the British Broadcasting Corporation (BBC), they are segregated in advertising periods at the beginning, midway through, and at the end of each program.

After the publication of *Psychology and Industrial Efficiency*, Münsterberg retained an interest in industrial problems. In the spring of 1913, he met with President Woodrow Wilson and the Secretaries of Commerce and Labor to urge the establishment of a government bureau devoted to scientific research on the application of psychology to the problems of commerce and industry. His proposals were well-received, although World War I disrupted practical plans for their implementation. In general, his work in industrial psychology has proved to be of great importance, and many of his concerns and interests are current interests among industrial psychologists. A contemporary reviewer said of his work:

> Overall, Münsterberg's grasp of the psychology of business and industry was impressive. In two books and a handful of articles, he laid the groundwork for every major development in these fields. He specified the problems and the goals, and indicated some of the methods to be used, for personnel psychology, vocational psychology, engineering psychology, consumer psychology, and other specializations in these areas . . . there should be no doubt that Hugo Münsterberg was the founder of the fields of industrial and business psychology as they exist today. (Moskowitz, 1977, p. 383)

Business Week Magazine also honored Münsterberg in a series of articles on "Famous Firsts in Industrial Psychology" (Hale, 1980, p. 6).

In addition to his work in industrial psychology, Münsterberg wrote extensively on teaching, education, and several other social issues. Though he neither smoked nor drank alcohol, Münsterberg opposed Prohibition and was actively involved in the debate over that burning issue. He even attempted to introduce a little levity to the controversy in an article in 1908 in the *Ladies Home Journal*, "The Temperance of Women." Münsterberg contrasted the intemperance of men for alcohol with the intemperance of women for candy and the latest fashions. A predictably outraged reaction greeted the article's publication, especially when it became known that Münsterberg had solicited and received financial support from the beer magnate Adolphus Busch (Hale, 1980, p. 119). Münsterberg also opposed sex education in the schools, arguing that such education would simply stimulate interest in sex. He fought a lifelong battle against what he called "naive psychology" and constantly challenged the claims of pseudopsychologists. He was also a critic of believers in the occult, mysticism, astrology, thought transference, and other psychical activities.

Münsterberg Honored and Defamed

Honors and awards came easily to Münsterberg. He was one of the charter members of APA and was elected APA's president in 1898. By the age of 29, he was a professor of philosophy at Harvard University, and in 1899, when he was 36, he became chairman of the department. The year before, he had declined an offer of a readership at Oxford University; in 1905, he was offered the chair of philosophy at the University of Königsberg, a position formerly occupied by Immanuel Kant. Münsterberg first accepted but then declined the position and remained at Harvard. These offers indicated an impressive recognition of his status, and Münsterberg was reportedly one of the highest paid Harvard professors of that era (Keller, 1979). Münsterberg wrote thirty-two books and sixty-one major papers. He played a major role in organizing a scientific congress held in conjunction with the 1904 St. Louis Exposition and traveled to Europe to extend invitations to some 150 scientists and scholars. He was elected president of the APA in 1899 and of the American Philosophical Association in 1907. In 1901, Harvard University awarded him an honorary master of arts degree, thus making him a "son of the house" and a "Harvard man." Münsterberg served Harvard loyally for twenty-five years. He organized the fundraising drive for Emerson Hall, the home of Harvard's Psychology Department for forty years. He served on the Nobel Prize nominating committee for physiology and medicine in 1906. He was a friend of the rich, the famous, and the important. He knew Andrew Carnegie, Bertrand Russell, H. G. Wells, Presidents Theodore Roosevelt and William Howard Taft, Kaiser Wilhelm II, Hollywood movie stars and moguls, and most of the leading American and European scholars and intellectuals of the time. However, when Münsterberg died in 1916, he disappeared almost immediately from the field of psychology. In one sense, he literally disappeared: a painting over the stairway in Harvard's Emerson Hall shows Wiliam James, Josiah Royce, George Herbert Palmer, and a vacant chair. That chair was to have been Münsterberg's, but his likeness was blocked out after his death (Roback, 1952, p. 208). Why did he become a lost psychologist?

An answer to this question can be found in Münsterberg's self-appointed role as spokesman for Germany in the United States and in his lifelong interest in improving relations and developing greater understanding between his native and adopted countries. In one of the first books he wrote in English, *American Traits*, published in 1902, Münsterberg ridiculed the false stereotypes Germans and Americans held about each other. He described the two societies, pointing out what he considered to be the good and bad points of each. In *The Americans* (1904) he provided detailed and insightful descriptions of American social, cultural, economic, political, and intellectual life primarily for a German audience. According to Münsterberg's daughter, this book

> made a stir among readers and, to a remarkable degree, awakened interest in American life. It even inspired readers to set sail and see for themselves a land that had been painted in such appealing colors. The secret of the book's influence was not so much the clearly presented new information as the convincing power of the enthusiastic author behind its statements. (M. Münsterberg, 1922, p. 333)

Unfortunately, Münsterberg did not have as much success improving the American perception of Germany. In 1905, Münsterberg was appointed by Harvard to serve as an exchange professor at the University of Berlin to establish a new American Institute there. The institute was dedicated to facilitating exchanges between scholars and scientists and establishing a collection of newspapers, magazines, and journals reflecting life in America. When Münsterberg returned to the United States in 1912, he constantly strove to counter the rising tide of American feeling against Germany. With the outbreak of World War I in 1914, his activities became increasingly unpopular, yet he persisted in writing articles and books presenting the German position, writing of the peaceful nature of the German people, and arguing for "fair play." After a German submarine sunk the *Lusitania* in May 1915, costing 1,200 lives including 124 Americans, Münsterberg received volumes of hate mail. Letters addressed to

"Dr. Monsterberg, Harvard," were delivered to him; he was accused of being a German spy and was censured, condemned, and ostracized even by some of his colleagues. Münsterberg, who had converted to Protestantism as a young man in Germany, was called "a very offensive Jew" by President Butler of Columbia (Winston, 1996, p. 38). An Englishman offered $10 million to Harvard University if the administration would dismiss Münsterberg immediately. However, Harvard stood firm. The canny Münsterberg offered to resign if the man would present $5 million to the university and $5 million to him, but the man refused. While this episode has a touch of humor, these were terrible years for Münsterberg. All things German became anathema to many Americans. The music of Wagner and Beethoven was banned, German-American businesses were attacked, and even dachshund dogs were attacked as unpatriotic. Pronunciation of the Connecticut town of Berlin was even changed to make it sound less German (Kornfeld, 1994). Perhaps it is just as well that Münsterberg did not live to see America enter World War I in 1917. The morning papers of December 16, 1916, brought news of peace offers, and Münsterberg said to his wife, "By spring we shall have peace." He left to give his morning lecture at Radcliffe, walked to the college through bitterly cold weather, and arrived exhausted, but he insisted on meeting his class. He entered the lecture hall, began to speak, and died in midsentence from a massive cerebral hemorrhage. He gave his first and his last American lectures at Radcliffe.

William McDougall

Münsterberg's successor at Harvard was the equally controversial English psychologist William McDougall (1871–1938). He established a psychological laboratory at the University of London and taught "moral philosophy" at Oxford. (Unlike London and Cambridge, Oxford was hostile to the new psychology.) His book *Introduction to Social Psychology* (1908) was an important foundational work in that area of psychology. In *Body and Mind,* he outlined a *purposive behaviorism* that emphasized motives and goals. McDougall served as a medical officer in World War I, specializing in the treatment of war neuroses. In 1920, he accepted a call to the chair of psychology at Harvard formerly occupied by Münsterberg.

The four-year delay in making this appointment was due to the faculty's desire to avoid another controversial psychologist. In that, they certainly failed; McDougall courted controversy with his interest in psychical research, his espousal of a doctrine of instinct in which ever-growing lists of instincts were said to *explain* human behavior, and his concept of a group mind. McDougall left Harvard in 1927 for a chair of psychology at Duke. There he established a *Laboratory of Parapsychology* under biologist Joseph B. Rhine (1895–1980). That laboratory became the world's leading center for parapsychological research, but that area of psychology has always been controversial. McDougall also supported the *Lamarckian hypothesis* that acquired characteristics are inherited (Chapter 9). He claimed to have shown inheritance of acquired (learned) behaviors in successive generations of selectively bred rats. His presentation of his results at the *Ninth International Congress of Psychology* at Yale in 1929 met "rudeness and insolence" (Jones, 1987, p. 933) and led Cattell to challenge the scientific credibility of his results (Alvarado & Zingrone, 1989, p. 446).

Always controversial himself, McDougall was a strident critic of others. Wundt's psychology was "a quagmire of pedantry, a mass of confusion and error, lacking even the modest merit of internal consistency." As for Titchener, "experimental psychology of the strict Wundtian type may be said to have died of pernicious anemia under the too drastic purgative treatment of Dr. Titchener" (McDougall, 1932, pp. 197–198). In turn, McDougall was vilified. For example, Knight Dunlap (Chapter 12) reported that on a visit to Duke University, he found McDougall in the process of dying from cancer, causing Dunlap to comment that "the sooner he died, the better it would be for psychology" (Dunlap, in Smith, 1989, p. 446).

TITCHENER AND MÜNSTERBERG IN RETROSPECT

Titchener and Münsterberg both earned doctoral degrees with Wundt at the University of Leipzig and shortly thereafter emigrated to the United States. As we have seen, at that point the similarity ends. In their definitions of psychology, their approaches, and their careers, they could hardly have been more different. Titchener defined psychology as the science of the mind and declared its task to be the search for the basic elements or structure of the human mind. Introspection under rigidly controlled experimental conditions was to be psychology's most important, indeed its defining, method. Münsterberg, in contrast, always refused to define his psychology, for no definition could be sufficiently inclusive. His aim was to study the workings or functions of the mind: how we learn, remember, perceive, and judge. While laboratory experiments were sometimes of value, Münsterberg favored work outside the laboratory and the application of psychological knowledge in a variety of settings: the psychological clinic, business and industry, and courts of law. Münsterberg is the acknowledged founder of applied psychology in the United States (Spillmann & Spillmann, 1993). Titchener adamantly opposed such applications, considering them technologies that were not part of the true science of psychology.

Contemporary psychology reflects Münsterberg's influence but little of Titchener's. Today there are no Titchenerian structuralist psychologists; in fact, there have not been any for many years. In contrast, many of Münsterberg's interests are still pursued by contemporary psychologists. However, histories of psychology often emphasize Titchener's role rather than that of Münsterberg. Boring (1957) in his classic history of psychology devoted ten times as much space to Titchener as he did to Münsterberg; the index to Watson's *The Great Psychologists from Aristotle to Freud* (1978) has twenty-three citations to Titchener and only six to Münsterberg; and Marx and Hillix in their *Systems and Theories of Psychology* (1979) devoted many pages to Titchener and none to Münsterberg. Such presentations show that Titchener continues to influence the way the history of psychology is written, but they misrepresent the relative importance of the two men.

Hermann Ebbinghaus.
(The Bettmann Archive)

CHAPTER 6

German Psychologists of the Nineteenth and Early Twentieth Centuries

Many psychologists trace their heritage to Wundt. As we have seen, Wundt is often given credit for the very founding of psychology. But Wundt's laboratory at Leipzig was not without German rivals, and Wundt was not without German critics. These competing approaches to the "new psychology" of the nineteenth century were also experimental, but they differed from Wundt's approach in the topics they emphasized. In their *psychophysics,* Ernst Weber and Gustav Fechner made precise measurements of sensation; Hermann Ebbinghaus studied memory under carefully controlled laboratory conditions; Franz Brentano, Carl Stumpf, and Oswald Külpe investigated mental acts including problem solving and attention.

PSYCHOPHYSICS

Gustav Fechner (1801–1887)

Like Wundt, Fechner was the son of a pastor, a man of independent thought and action who once shocked his congregation by placing a lightning rod on his church. "Surely," he was asked, "the Lord will protect his own?" "Perhaps," said Pastor Fechner, "but the laws of physics must also be respected" (Boring, 1957, p. 276). After a *Gymnasium* education, Fechner studied medicine at the University of Leipzig, where he remained for the rest of his life, some seventy years. He took a medical degree in 1822, but thereafter his interests turned toward physics and mathematics. By 1830, he had published more than forty works, including an important paper on the measurement of electrical direct current. In the next decade, Fechner turned to more psychological topics and published papers on color vision and positive afterimages—the visual sensations that continue after the visual stimulus that produced them is no longer present, such as the image of a light bulb that remains for a brief period after the electricity has been switched off. For these experiments, Fechner needed a bright stimulus, and so he stared at the sun. He injured his eyes and became ill and so depressed that in 1839 he had to resign his position as a professor of physics.

For three years Fechner suffered a physical and psychological crisis, but then he suddenly recovered. Fechner always regarded his recovery as the miraculous turning point in his life. He became deeply committed to *Pietism,* a movement prominent within the German Lutheran church of his time that stressed personal piety over religious orthodoxy. Fechner renounced what he saw as the materialism of both his earlier life and much of contemporary science. Instead of continuing to do scientific research, he turned to poetry and metaphysics. When Fechner considered the perennial metaphysical question concerning the nature of mind and matter, he concluded that the two could be related; but how could that relationship be described? The answer came to him "before getting out of bed" on the morning of October 22, 1850 (Boring, 1961, p. 4). He would describe the relationship between body and mind, between the material and the mental, by quantifying the relationships between the physical and psychological worlds. He would base his descriptions on the work of his colleague at Leipzig, Ernst Weber (1795–1878), a man Fechner generously called "the Father of psychophysics."

In 1834, Weber had published a great Latin treatise, *De tactu,* describing his experiments on touch. Weber first measured the minimum amount of tactile stimulation necessary to experience a sensation of touch. His subjects could not sense very weak stimuli, but they nearly always sensed intense ones. Between these two intensities was a *limen,* or threshold, at which tactile stimuli are first perceived—*the absolute threshold.* Weber also investigated the ability of people to discriminate between two weights when the weights were either resting on the hand (touch alone) or lifted (touch and muscular exertion). His subjects were able to discern smaller differences in the latter case as a result, Weber believed, of sensations coming from the muscles.

Using aesthesiometric compasses, Weber tested the ability to discriminate between two points of tactile stimulation. When the two points were very close together, they were often reported as one stimulation point; when far apart, as two. Between these two extremes of perception was a threshold where one touch sensation becomes two or two become one—the *two-point discrimination threshold.* Weber found that this threshold varied on different parts of the body. On the fingertips, it was 0.22 cm; on the lips, 0.30 cm; and on the back, 4.06 cm.

Weber also investigated how much a stimulus must change in order for a person to sense the change. First Weber had his subjects lift a standard weight. Then they lifted a second comparison weight and judged which weight was heavier. Weber's subjects reported large differences consistently, but small differences often went undetected. Weber asked how large the difference between two weights had to be before it was detected reliably. Putting the question another way, What was the *eben merklichen Unterschiede* (just noticeable difference or jnd) between two weights? Weber found that the jnd was not fixed but varied depending on the specific weights considered. If the standard was 30 grams, the comparison weight would have to be at least 33 grams (jnd $= +3$ grams) to be judged as different; if the standard was 90 grams, the comparison weight would have to be at least 99 grams (jnd $= +9$ grams) to be judged as different.

The physical difference required to detect a psychological difference varied with different weights.[1]

Weber conducted similar experiments with lines of different lengths, and found the ratio was about 1/100: subjects could reliably differentiate a line of 99 millimeters from one of 100 millimeters; and one of 198 millimeters from one of 200 millimeters. This ratio or fraction was described by the formula

$$\frac{\Delta R}{R} = k$$

where $\Delta(R)$ is the just noticeable stimulus (in German, *Reiz*) increment, *R* is the standard stimulus magnitude, and *k* is a constant. The actual ratios Weber found were one-sixtieth for vision, one-thirtieth for pain, one-tenth for tones, one-fourth for smell, and one-third for taste. Different senses had different ratios, but in all cases there was not a linear correspondence between the physical world and one's psychological experience of it.

Weber's results provided exactly the type of precise description of the relationship between the physical and psychological worlds Fechner was seeking. Like Weber, Fechner measured the relationship between the power or magnitude of many different types of stimuli and their perceived intensity. He described his results in *Elemente der Psychophysik* (Elements of Psychophysics), published in 1860. Fechner found, as had Weber, that as the magnitude of a stimulus increases, more and more of an increment in intensity is needed to produce a perceptible difference. Through a series of mathematical steps, Fechner transformed Weber's ratio to the formula

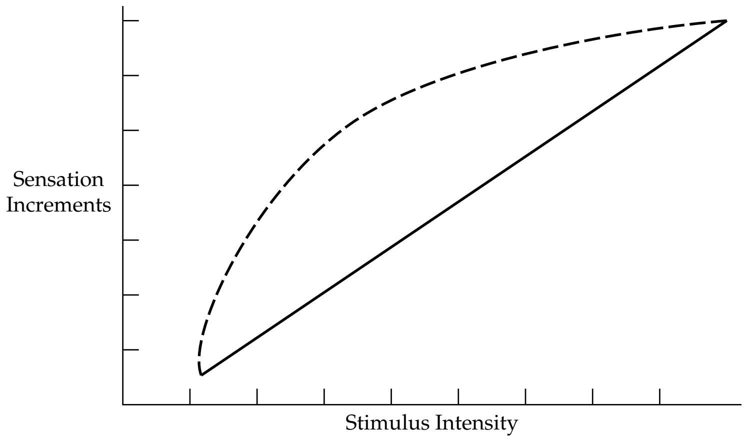
$$S = k \log R$$

where *S* is the sensation, *k* is a constant, and *log R* is the logarithm of the physical intensity of the stimulus. A graph of this nonlinear function on page 178 shows a complex relationship between the physical and psychological worlds. Considering the difference between the linear relationship shown by the solid line and the actual relationship shown by the dotted line, one might ask: Where does the curvilinearity, or bend, come from? Fechner's answer was that it comes from the mind. It is the active mind that "bends" the function, and thus the bend is a measure of the mind's activity. A psychological process had been measured, with the results expressed in a mathematical equation.

Psychophysics in Perspective

For many nineteenth-century psychologists, including Wundt, Weber and Fechner's experiments were a model of careful, painstaking research. They were convinced that such research was necessary for the development of the new science of psychology. However, Weber and Fechner had critics who contended that sensations are not measurable, that the jnd was not a proper unit

[1] In 1738, Daniel Bernoulli (1700–1782) had pointed out that giving a *franc* to a poor man produces more gain than 10 *francs* to a wealthy man. Psychological gains in wealth (*fortune morale*) are relative to economic status (*fortune physique*); in modern economics, this is referred to as the Law of Diminishing Marginal Utility.



of measurement, and that Weber's law and Fechner's logarithmic transformation were invalid. For the American psychologist William James (Chapter 9), "Fechner's book was the starting point for a new department in literature, which it would be impossible to match for the qualities of thoroughness and subtlety, but of which, in the humble opinion of the present writer, the proper psychological outcome is just nothing" (James, 1890, vol. I, p. 534). A few pages later, James concluded:

> But it would be terrible if even such a dear old man as this [Fechner] could saddle our Science forever with his patient whimsies, and, in a world so full of more nutritious objects of attention, compel all future students to plough through the difficulties, not only of his own works, but of the still drier ones written in refutation. Those who desire this dreadful literature can find it; it has a disciplinary value. . . . (James, 1890, vol. I, p. 549)

Throughout his career, Fechner remained confident about his approach to psychology; in 1877 he directed these defiant final words to his many critics: "The tower of Babel was never finished because the workers could not reach an understanding of how they should build it; my psychophysical edifice will stand because the workers will never agree on how to tear it down" (author's translation; Fechner, 1877, p. 215).

Contemporary psychologists still use psychophysical techniques to study sensation and perception. Since Fechner's time, catch trials (with no stimulus present) have typically been inserted into a series of stimulus presentations to keep the subject alert and attentive. Signal detection procedures today use catch trials to measure sensitivity and response bias, that is, the subject's ability to detect the signal, his or her certainty that a signal has been detected, and any preference for one response over another (Hochberg, 1979). Psychophysical methods have also been used to answer more complex questions of judgment: How do different cultures perceive the "absolute threshold" for criminal behavior? When are human actions considered criminal? How do different professions and careers differ in status? What are the relative intensities of different hostile acts in international conflict and different friendly acts in international cooperation? (Stevens, 1966). A *Scenic Beauty Estimation Method*, based upon classical psychophysics, even has been used to measure the perceived quality of natural environments (Daniel & Boster, 1976; Daniel, 1990). Each year, psychophysicists celebrate October 22, the anniversary of Fechner's morning insight (Krueger, 1993). Their number is not large, but their enthusiasm for Fechner and his methods is great.

One of Fechner's more striking speculations concerning consciousness has found contemporary support. Fechner knew that the brain is bilaterally symmetrical, that it has two halves that are virtually mirror images of each other (Chapter 3). He also knew that there is a deep division between the two halves, which are linked by a connecting band of fibers called the *corpus callosum.* Fechner speculated that if the *corpus callosum* was transected or "split," two separate streams of consciousness would result; the mind would become two. Fechner believed that his speculation would never be tested. He was wrong, but it was not until the mid-twentieth century, when Roger Sperry studied discrimination learning in cats with split brains, and later, when Sperry and Michael Gazzaniga worked with epileptic patients with a sectioned *corpus callosum,* that Fechner's speculation was shown to be correct (Gazzaniga, 1970).

The work of Weber and Fechner was instrumental in advancing the study of sensation and perception. Other German psychologists shared an interest in these topics, but more importantly, they sought to extend the experimental rigor of psychophysics to the study of higher mental processes and mental actions such as learning, memory, ideation, imagination, and judgment. Hermann Ebbinghaus was one of the German psychologists strongly influenced by Fechner's approach. He was to lay the foundation for contemporary psychological research on memory and to make one of the most enduring contributions to psychology.

HERMANN EBBINGHAUS (1850–1909)

Hermann Ebbinghaus was born January 24, 1850, the son of a merchant in the town of Barmen near Bonn in the Prussian Rhineland. At the local *Gymnasium,* he received a classical education preparatory to university studies. Ebbinghaus entered the University of Bonn at the age of 17 and also studied at Berlin and Halle, two universities whose faculties he was to join later in life. The Franco-Prussian War interrupted his studies, and Ebbinghaus served in the Prussian Army from 1870 to 1871. After his military service, he returned to the University of Bonn and in 1873 received his Ph.D. with highest honors for his dissertation on *Hartmann's Philosophy of the Unconscious.* He spent the years following his military service traveling in England and France, attending university classes and seminars, and working for short stints as a teacher and private tutor. While browsing through a Parisian used bookstall, he found a copy of Fechner's *Elemente der Psychophysik.* Ebbinghaus was captivated by Fechner's description of psychophysics and became fired with the conviction that psychology, like psychophysics, could become a natural science. He believed that procedures similar to Fechner's objective, psychophysical procedures could be developed and applied to higher mental processes. Some time around 1877, Ebbinghaus set out to develop such procedures for studying the higher mental process of memory.

Many years later, when he published his major psychological work, *Grundzüge der Psychologie* (Fundamentals of Psychology) (1902), he dedicated the book to Fechner: "Ich hab' es nur von Euch" (I owe everything to you).

Ebbinghaus's Early Academic Career

In 1880, Ebbinghaus was appointed a *Privatdozent* or private tutor at the University of Berlin, and there he continued his research on memory. While some had engaged in speculation and reflection about memory before Ebbinghaus, his were the first systematic experimental investigations (Herrmann & Chaffin, 1988). The research of Ebbinghaus was highly original. He did not have a teacher from whom he could learn and whose materials, techniques, and procedures he could use. Fechner, who had inspired the studies, was an old man of nearly 80, living in quiet retirement in Leipzig. As visiting American psychologist G. Stanley Hall (Chapter 9) described him, Fechner was:

> A curiosity. His eyelids are strangely fringed and he has had a number of holes, square and round, cut, Heaven knows why, in the iris of each eye—and is altogether a bundle of oddities in person and manners. He has forgotten all the details of his *Psychophysik;* and is chiefly interested in theorizing how knots can be tied in endless strings, and how words can be written on the inner side of two slates sealed together. (Hall, in Benjamin, 1988, p. 175)

Ebbinghaus was not a member of a department of psychology and did not have a research laboratory or colleagues with similar interests and research programs. Finally, Ebbinghaus did not have access to a large pool of subjects for his experiments, so he performed most of them on himself. Despite these limitations, he did some of the most remarkable investigations in the history of psychology (Roediger, 1985).

Ebbinghaus was a meticulous researcher who followed rigorous experimental rules. His first series of experiments was completed by the end of 1880, but such was his caution that he spent the next four years replicating and extending them before describing his results in the monograph *Über das Gedächtnis* (On Memory), published in Leipzig in 1885. The manuscript was handwritten in a fine hand in high, scholarly German. The work was well-received, and the value and originality of Ebbinghaus's contribution were widely recognized.[2]

Ebbinghaus realized early that familiarity has a powerful effect on learning and memory, so he set out to devise unfamiliar materials for his memory experiments. The result was his famous nonsense syllables. The term *nonsense syllable* has been universally used to describe the materials Ebbinghaus used, but is a slight misnomer. He constructed his syllables by permutating 19 consonants, 11 vowels, and 11 consonants[3] in that consonant-vowel-consonant order (Gundlach, 1986). The permutation produced $19 \times 11 \times 11 = 2{,}299$ different

[2] This manuscipt was presented to Professor Bahrick of Ohio Wesleyan University by Ebbinghaus's son, Julius Ebbinghaus, himself a Professor of Philosophy. A copy is in the author's collection of historical documents.

[3] The number of consonants for the endings of the syllables was smaller owing to a peculiarity of the German language.

syllables. It is sometimes said that Ebbinghaus eliminated syllables he judged to have meaning. Gundlach, however, asserts that Ebbinghaus used every single syllable. Gundlach points out that it would have been difficult for Ebbinghaus to eliminate syllables because he was fluent in German, English, and French and had studied Latin and Greek, so many of them would have had meaning for him (Gundlach, 1986, p. 469). Devising nonsense syllables was a creative act; they had not been constructed before Ebbinghaus's time but have been used extensively in memory research ever since. How did Ebbinghaus come to invent the nonsense syllable? In 1871, Lewis Carroll[4] published *Through the Looking Glass,* and *What Alice Found There* to popular acclaim. The first and last verses of its poem "Jabberwocky" read as follows:

> Twas brillig, and the slithy toves
> Did gyre and gimble in the wabe;
> All mimsy were the borogoves,
> And the mome raths outgrabe.
> (Carroll, 1871; miniature edition, 1940, p. 22)

Shakow (1930) speculated that while he was in London in 1876, Ebbinghaus must have read the famous children's story containing Carroll's nonsense parody of the English language. It thus would have given him the idea for the nonsense syllable. Whatever their genesis, nonsense syllables, with their homogeneity and lack of familiarity, were ideal for Ebbinghaus's experiments.

The Ebbinghaus Experiments

Ebbinghaus used nonsense syllables to investigate several broad questions. First he examined the relationship between the amount of material to be memorized and the time and effort required to learn it to a criterion of "complete mastery." To do this, he read out loud lists of nonsense syllables and repeated them back, all in time to a metronome.[5] Ebbinghaus recorded the number of repetitions necessary before he could repeat lists with different numbers of nonsense syllables perfectly and without hesitation. While longer lists required more repetitions before mastery, the relationship is not a simple one.

[4] Lewis Carroll was the pen name of the Reverend Charles Lutwidge Dodgson (1832–1898), a mathematics tutor at Oxford. In *Alice* we see a first-class brain at play, which is infinitely better than a second-class brain at work. Queen Victoria was so delighted with his account of Alice's adventures that she ordered other books by the same author. The queen must not have been amused to receive Dodgson's *Formulae of Plain Trigonometry, An Elementary Treatise on Determinants* and *Symbolic Logic* (Collins, 1932). A contemporary editor described *Symbolic Logic* as "one of the most brilliantly eccentric logic textbooks every written" (Bartley, 1977, p. 3), but it is Dodgson's books for children that are so widely loved. After the Bible and Shakespeare, Lewis Carroll is the most widely quoted and translated author in the Western world (Jenkyns, 1998, p. 38).

[5] Ebbinghaus did not use a *memory drum* in his research. That device, based on a rotating kymograph drum, was designed by Georg Elias Müller (1850–1934) and used in his experiments on memory in the 1890s. It allowed a list of words or other stimuli to appear for fixed periods of time (Evans, 2000, p. 323). A later model is in the collection of historical instruments at the University of Toronto.

Number of Nonsense Syllables on the List	Number of Repetitions to the First Errorless Reproduction (excluding it)
7	1
12	17
16	30
24	44
36	55

(Ebbinghaus, 1885, p. 47)

Ebbinghaus also assessed the effects of different amounts of learning on memory. He used different lists, all of which had sixteen nonsense syllables, and varied the number of repetitions of each one. All lists were then relearned twenty-four hours later. The times required to relearn the list were recorded and are shown in the following table:

Number of Original Repetitions	Time Needed to Relearn the List 24 Hours Later (in seconds)	Resulting Time Saved (in seconds)
0	1,270	—
8	1,167	103
16	1,073	192
24	975	295
32	863	407
42	697	573
53	585	685
64	454	816

(Ebbinghaus, 1885, p. 56)

The relationship is clear: as the number of original repetitions increases, the time necessary to relearn the list twenty-four hours later decreases. Given such a strong negative relationship, one might wonder why Ebbinghaus did not pursue it further, using still larger numbers of repetitions. Ebbinghaus rather dryly explained:

> I have not investigated this question by further increasing the number of repetitions of unfamiliar sixteen-syllable series because, as has been already noted, with any great extension of the tests the increasing fatigue and a certain drowsiness caused complications. (Ebbinghaus, 1885, p. 59)

Some experiments were not possible even for the dedicated Ebbinghaus! Nonetheless, this experiment suggests the importance of overlearning. Since the previous set of results showed that a list of sixteen nonsense syllables required some thirty repetitions to master, it is clear that a number of the lists in the second experiment were overlearned, and it is those lists which produced high savings scores.

In his best-known experiment, Ebbinghaus investigated the effects of the passage of time on memory. He learned eight lists of thirteen nonsense syllables until he could reproduce them perfectly twice. After varying amounts of time, he relearned the lists, and then used the number of repetitions required for relearning in the following formula to calculate a "savings score":

$$\frac{\text{Number of original repetitions} - \text{number of relearning repetitions}}{\text{Number of original repetitions}} \times 100$$

Thus, the smaller the number of relearning repetitions, the higher the calculated savings score. Ebbinghaus's results are shown in the following table:

Interval between Original Learning and Relearning	Percent Saved	Percent Lost
0 minutes	100	0
20 minutes	58	42
60 minutes	44	56
9 hours	36	64
24 hours	34	66
2 days	28	72
6 days	25	75
31 days	21	79

(Ebbinghaus, 1885, p. 76)

A graph of these results, with the time elapsed since learning plotted on the abscissa and the percent savings plotted on the ordinate, shows the course of forgetting over time. The curve that results is a classic in psychology, appearing in many contemporary textbooks. Its most startling aspect is the large initial drop in retention, especially considering the stringent learning criterion Ebbinghaus used. Over 50 percent of the material learned was lost after only sixty minutes, and 66 percent was lost after twenty-four hours. While such a curve is often identified as Ebbinghaus's curve of forgetting, Ebbinghaus did not graph the results this way. Rather, he developed a mathematical model for forgetting by writing a logarithmic equation for the function and deriving its parameters by the method of least squares (Roediger, 1985, p. 521). Such sophisticated statistical techniques were typical of Ebbinghaus. He introduced the concepts of mean and variability and developed a way of comparing performance under different conditions by seeing if the difference between means exceeded what one would expect on the basis of probable error.

Ebbinghaus also investigated the relative effects on memory of spaced versus massed, part versus whole, and active versus passive learning. He found that in general, active, spaced learning of material as a whole is most effective. He also found meaningful material, such as poetry or prose, much easier to learn and remember than material without meaning. To learn six stanzas from Byron's *Don Juan* took him only eight repetitions; a nonsense syllable list of the same length took from seventy to eighty repetitions. In addition, internal analyses of his results indicated that lists learned before he went to sleep were retained better than lists learned at other times of the day. This finding—that sleep slows forgetting, relative to waking activity—was confirmed some forty years later by Jenkins and Dallenbach (1924) in what has come to be a classic paper.

Ebbinghaus's research was widely recognized as a highly significant contribution to the scientific development of psychology. For the first time, a higher mental function had been studied experimentally. The leading American psychologist, William James (Chapter 9), viewed Ebbinghaus as one of Germany's "best men," an opinion shared by many of James's American colleagues. Predictably, Titchener's reaction was initially less favorable. In 1910 he stated that "the introduction of nonsense syllables . . . has nevertheless done psychology a certain disservice. It has tended to place the emphasis upon the organism rather than upon the mind" (Titchener, 1910, p. 414). However, this was one of the rare occasions when Titchener changed his mind. In 1928, he wrote, "It is not too much to say that the recourse to nonsense syllables, as a means to the study of association, marks the most considerable advance in this chapter of psychology, since the time of Aristotle" (Titchener, 1928, p. 125). In a retrospective review marking the centennial of the publication of *On Memory,* Henry Roediger described the book as recording "one of the most remarkable research achievements in the history of psychology" (Roediger, 1985, p. 519). In his review, Roediger used words such as "remarkable," "astounding," and "incredible" to refer to Ebbinghaus and his research on memory.

The centennial of *On Memory* was marked by conferences held at Passau University in Germany and Adelphi University in the United States (Gorfein & Hoffman, 1987); a symposium ("Where Is Memory Research 100 Years After Ebbinghaus?") at the 1985 meeting of the Psychonomic Society held in Boston; and a special issue of the *Journal of Experimental Psychology: Learning, Memory, and Cognition* (July 1985) devoted to Ebbinghaus.

The success of Ebbinghaus's memory experiments established a paradigm of laboratory experimentation on memory which dominated psychology for ninety years. But over the last two decades, this paradigm has been challenged. Ulric Neisser (1978, 1982, 1988) asserted that psychological research on memory has been too narrowly based on artificial laboratory tasks. Further, he argued that such tasks lack ecological validity and do not provide information relevant to interesting or socially significant aspects of memory. Neisser rebuked psychologists for their "thundering silence" on topics of great interest to ordinary people: how we remember information, arguments, or material relevant to a particular problem or situation; why we can remember our hometown of thirty years ago but not this afternoon's appointments. Why can students remember the starting World-Series lineup of the 2001 New York Yankees, but not the topic of last week's class? Neisser's principal aim was to encourage psychologists to do more naturalistic or ecologically valid research and to try to answer practical, everyday questions rather than constructing theories of memory based upon laboratory studies.

In a significant series of studies, actually begun before Neisser's manifesto but certainly in keeping with his proposal, Harry Bahrick and his colleagues tested long-established memories (Bahrick, Bahrick, & Wittlinger, 1975; Bahrick, 1983, 1984). They found that thirty-four years after graduating from high school, people performed as well as recent graduates at matching the names and faces of their classmates. However, on a recall test in which they were asked to recall classmates' names from their pictures, the older graduates showed a considerable loss in memory. In another scenario, people were able to describe accurately landmarks in the town they had grown up in but left behind many years ago. Bahrick also found that a large portion of the semantic content of Spanish learned in high school endures in a "permastore" for more than fifty years in the absence of further rehearsal, while other portions are lost within three to five years.

While these innovative investigations are impressive, ecological approaches to memory have not been without their critics. In a provocative paper, Banaji and Crowder (1989) defended the value of laboratory approaches to the study of memory and concluded that despite its "superficial glitter," ecological memory research was "bankrupt" (Banaji & Crowder, 1989, p. 1192). Reactions were strong, and a debate arose (Gruneberg, Morris, & Sykes, 1991; Bahrick, 1991; Banaji & Crowder, 1991). Both approaches surely have value. As Neisser himself has stated: "I believe that future relations between ecological and traditional studies are more likely to be complementary than antagonistic" (Neisser & Winograd, 1988, p. 215).

One year after the publication of *On Memory,* Ebbinghaus was appointed *Professor extraordinarius* at the University of Berlin. He was approaching the peak of German academic life, but paradoxically, though he had promised further memory research in his book, he chose not to continue that work. Perhaps, as Roediger (1985) suggested, Ebbinghaus was distracted by administrative duties, journal editing, and textbook writing. An additional reason might have been that the University of Berlin was the home of Hermann von Helmholtz, the world's leading authority on sensory physiology (Chapter 3). Following Helmholtz's example, Ebbinghaus became interested in sensory physiology, sensation, and perception. In 1890, Ebbinghaus and Arthur Konig established the *Zeitschrift für Psychologie und Physiologie der Sinnesorgane* (Journal of Psychology and Physiology of Sense Organs). Ebbinghaus edited the journal and from all accounts was fair-minded and tolerant of views other than his own. In 1893, he published a theory of color vision, but his contributions to sensory physiology were judged not to have been of the highest quality, and so he was passed over for promotion to a chair at Berlin. He moved to the University of Breslau in 1894 and stayed there until 1905, when he moved to the University of Halle.

Ebbinghaus Tackles an Applied Problem

In July 1895, the municipal authorities of Breslau wrote a letter to the Hygiene Section of the Silesian Society for National Culture, requesting some justification for the way in which the German school day was arranged. Children went to school in one uninterrupted session from 8:00 A.M. to 1:00 P.M. Their fatigue and nervous irritability seemed to increase as the day went on, so the authorities wondered if a different arrangement of the school day might be better—perhaps morning and afternoon sessions with a midday break. The society appointed a committee to investigate this question and make recommendations. The committee saw the need for an objective measure of changes in a child's mental powers during the day. H. Griesbach, a German physiologist, proposed that two-point discrimination thresholds be used to measure mental fatigue. He believed that such fatigue would impair a child's ability to distinguish between two points of stimulation on the skin and proposed to use this psychophysical measure to assess changes in children's mental powers.

Sir Frederick Bartlett and the War of the Ghosts

In 1932, Frederick Bartlett published *Remembering: A Study in Experimental and Social Psychology,* a book Roediger described as "the next great book about memory, after Ebbinghaus's *On Memory* (Roediger, 1997, p. 488). While acknowledging the "exact methods" of Ebbinghaus, Bartlett avoided what he considered the artificiality of nonsense syllables. His investigations of memory were not formal experiments with independent and dependent variables, but controlled demonstrations. His results are reported as narratives, and Bartlett is adamant that "in this book there will be no statistics whatever" (Bartlett, 1932, p. 9). In the most often cited of Bartlett's demonstrations, students in the Laboratory of Experimental Psychology at the University of Cambridge read the following story twice:

THE WAR OF THE GHOSTS

One night, two young men from Egulac went down to the river to hunt seals, and while they were there it became foggy and calm. Then they heard war cries, and they thought: "Maybe this is a war party." They escaped to the shore and hid behind a log. Now canoes came up, and they heard the noise of paddles, and saw one canoe coming up to them. There were five men in the canoe and they said:

"What do you think? We wish to take you along. We are going up the river to make war on the people."

One of the young men said: "I have no arrows."

"Arrows are in the canoe," they said.

"I will not go along. I might be killed. My relatives do not know where I have gone."

So one of the young men went, but the other returned home. And the warriors went on up the river to a town on the other side of Kalama. The people came down to the water, and they began to fight, and many were killed. But presently the young man heard one of the warriors say: "Quick, let us go home: that Indian has been hit." Now he thought: "Oh, they are ghosts." He did not feel sick, but they said he had been shot.

So the canoes went back to Egulac, and the young man went ashore to his house and made a fire. And he told everybody and said: "Behold, I accompanied the ghosts, and we went to fight. Many of our fellows were killed, and many of those who attacked us were killed. They said I was hit, and I did not feel sick."

He told it all, and then he became quiet. When the sun rose, he fell down. Something black came out of his mouth. His face became contorted. The people jumped up and cried. He was dead.[6] (Bartlett, 1932, p. 65)

Students then reproduced this story after fifteen minutes and successively every two months for as long as two years and six months.[7] Successive reproductions showed more organized and rational stories, with some details omitted and others added. Themes, or what Bartlett termed *schemas,* were

[6] Bartlett adapted a translation by Franz Boas of a North American Indian folktale. He omitted one salient detail. In the Boas translation, at the story's climax, "Something black came out of his mouth and blood came out of his anus." Bartlett apparently felt that this detail would be offensive and so omitted it (Roediger, 1996).

[7] As was usual in Bartlett's demonstrations, procedures were not carefully controlled. Time intervals varied and not all students were tested.

Griesbach measured two-point discrimination thresholds when the children entered school in the morning and at the end of every class hour. As a control procedure, he also tested them on free days when they were at home. Griesbach found a considerable blunting of sensitivity that reached its maximum around the third hour of the school day, and so he recommended that the day be broken into two shorter segments. The committee, mostly made up of

Sir Frederick Bartlett and the War of the Ghosts *(Continued)*

maintained when intervals between reproductions were short; when intervals were longer, the *schemas* often changed. The following reproduction after four months illustrates the changes Bartlett recorded:

> Two youths went down to the river to hunt for seals. They were hiding behind a rock when a boat with some warriors in it came up to them. The warriors, however, said they were friends, and invited them to help them to find an enemy over the river. The elder one said he could not go because his relations would be so anxious if he did not return home.
>
> So the younger one went with the warriors in the boat.
>
> In the evening he returned and told his friends that he had been fighting in a great battle, and that many were slain on both sides.
>
> After lighting a fire, he retired to sleep. In the morning, when the sun rose, he fell ill, and his neighbors came to see him. He had told them that he had been wounded in the battle but had felt no pain then. But soon he became worse. He writhed and shrieked and fell to the ground dead. Something black came out of his mouth.
>
> The neighbors said he must have been at war with the ghosts. (Bartlett, 1932, p. 75)

Two-and-a-half years later, the reproduction was further abbreviated but the *schema* was maintained:

> Some warriors went to wage war against the ghosts. They fought all day, and some of their number was wounded. They returned home in the evening, bearing their sick comrade. As the day drew to a close, he became rapidly worse and the villagers came round him. At sunset he sighed; something black came out of his mouth. He was dead. (Bartlett, 1932, p. 75)

In Bartlett's Method of Repeated Reproduction, a chain of reproductions was created: student A reads the story, then repeats it to B, who repeats it to C, and so on. Similar changes in memory were observed.

Bartlett also used visual materials in his demonstrations. In one frequently cited result, a representation of the Egyptian *mulak,* an owl-like figure, changes in a series of reproductions to a cat (Bartlett, 1932, p. 180). The results of these demonstrations supported Bartlett's view that memory is active, constructive, and individual. He concluded, "If there is one thing upon which I have insisted more than another throughout all the discussions in this book, it is that the description of memories as 'fixed and lifeless' is merely an unpleasant fiction"(Bartlett, 1932, p. 311). Acknowledging criticisms of Bartlett's demonstrations for their informality and lack of statistical analysis of the results, and of his book, which rarely refers to earlier research on memory except to dismiss it, Roediger nevertheless concluded:

> Despite these possible criticisms, Bartlett's great book stands as one of the permanent milestones in the psychology of memory. His achievements outweigh any faults; 'tis better to be right than precise, he might retort. (Roediger, 1997, p. 492).

For his contributions to psychology, Bartlett was knighted Sir Frederick.

Source: Reprinted with the permission of Cambridge University Press. *Remembering: A Study in Experimental and Social Psychology,* 1st ed. Bartlett, F. C., exerpts from pp. 9, 65, and 75.

physicians, was impressed by Griesbach's investigations, but Ebbinghaus, who was not a committee member, was less favorable. He agreed that the testing had been done well, but argued that the test procedure was not suited to the purpose—what today is referred to as the *content validity* of a psychological test. Ebbinghaus proposed using exclusively psychological rather than psychophysical measures of the mental processes of declining attention and increased fatigue. The committee accepted Ebbinghaus's criticisms and commissioned him to devise a number of tests. He accepted the charge, but quickly became concerned with the more general question of the nature of intelligence.

Ebbinghaus viewed intelligence as a general ability to combine pieces of information, see relationships and associations, and arrive at correct conclusions. This ability, he believed, is what distinguishes the outstanding person in any field, whether it be a physician who must make a diagnosis based on incomplete information, or a general who in the fog and terror of battle must make tactical decisions based upon uncertain, at times conflicting, information. Ebbinghaus devised analogy and completion test items to tap this sort of reasoning ability. To do well on the analogy tests, a child had to recognize a rule to complete the analogy

July is to May as Saturday is to ________.

The completion tests involved having a child complete a passage or sentence:

Big things are heavier than ________ things.

________ are always younger than their fathers.

The appropriateness of each completion was judged, as was the speed with which the child made it. Later, completion tests such as the ones Ebbinghaus introduced were used by Alfred Binet (Chapter 11) when he developed his first intelligence test. In addition to the two tests of general reasoning, Ebbinghaus used tests to measure the child's ability to do basic arithmetic.

Ebbinghaus gave his tests to schoolchildren in Breslau and compared their test scores with their scholastic records and standing. His completion tests discriminated best between children with good, average, and poor grades. Ebbinghaus believed that this test measured a combining function central to intelligence. Though Ebbinghaus made progress in understanding and measuring intelligence, the original question of how the school day should be arranged somehow got lost. Today, many German schools still operate from 8:00 A.M. to 1:00 P.M.

Ebbinghaus in Perspective

Ebbinghaus was an innovator and pioneer; but, unlike Wundt, he did not have followers and did not establish a school of psychology. His influence on psychology derives from his impressive experimental research on memory, his pioneering work on the measurement of intelligence, and his writings. His *Grundzüge* (Fundamentals) and *Abriss der Psychologie* (Summary of Psychology), published in 1902 and 1905, respectively, were used as psychology texts throughout the world. When one pages through the original editions of these books, they appear formidable and intimidating, but closer inspection shows that Ebbinghaus had a clear and precise prose style. The opening sentence of the *Abriss* (Ebbinghaus, 1910, p. 9), "Psychology has a long past but only a short history," is a description which has perplexed and fascinated many psychologists interested in the history of their science.

Ebbinghaus died suddenly of pneumonia in 1909 at the age of 59. In an appreciation written after his death, Robert Woodworth (Chapter 10) wrote: "The sudden death of Dr. Ebbinghaus, professor of philosophy at Halle, is felt as a severe loss throughout the world, for few psychologists were more international in their reputation and sympathies" (Woodworth, 1909, p. 253). In a September 1909 lecture at the Clark Conference (described in Chapter 9), Titchener movingly expressed his feelings:

> Nevertheless, as I approach the topic of this lecture, what is uppermost in my mind is a sense of irreparable loss. When the cable brought the bare news, last February, that Ebbinghaus was dead, just a month after the celebration of his 59th birthday, the feeling that took precedence even of personal sorrow was the wonder of what experimental psychology would do without him. (Titchener, 1910, pp. 404–405)

Titchener described Ebbinghaus's death as a "grievous loss" and predicted that Ebbinghaus's works might prove as important as those of Wundt. From Titchener, that was the ultimate accolade, and his words were prescient. Ebbinghaus's memory experiments have a secure place among psychology's most important contributions.

FRANZ BRENTANO (1838–1917)

Franz Brentano was born in 1838 in the town of Marienburg on the German Rhine. His was a distinguished literary family, with his father being a published writer (Puglisi, 1924). His father died when Brentano was thirteen, so he was raised by his mother, a pious and cultivated lady whose ambition was that her son be ordained as a Catholic priest. Brentano first entered the University of Berlin, where he studied philosophy, especially the works of Aristotle. These studies made a lasting impression on Brentano, and all his life he looked back to the teachings of philosophers in considering psychological topics. In 1856, he transferred to the University of Munich and was influenced there by Johann Joseph Ignaz von Döllinger (1799–1890). Döllinger, who was recognized as a great teacher and a distinguished historian and theologian of the Catholic church, tutored Brentano in the teachings of St. Thomas Aquinas. Encouraged by his mother and inspired by Döllinger's example, Brentano decided to study for the priesthood. He was ordained a Dominican priest in the summer of 1864.

In 1866, Brentano accepted a position as a lecturer at the University of Würzburg while continuing to live a monastic life with his brother Dominicans. But that life ended when Brentano published a scholarly critique of the doctrine of papal infallibility. He concluded that, based on historical evidence, the doctrine was impossible to accept (Puglisi, 1924, p. 415). In 1870, when the Vatican Council reaffirmed papal infallibility as an article of faith, Brentano struggled to resolve his conflict between faith and reason. In 1872 he left the Dominican order and resigned from his academic appointment.

Brentano's Contribution to Psychology

Brentano used the time of his forced hiatus from university life to write *Psychology from an Empirical Standpoint.* The book's success secured his appointment as a layman to the faculty of the University of Vienna. Brentano spent six years (1874–1880) as a *Professor ordinarius* at Vienna. The psychology Brentano outlined was intended to be empirical in the sense that it was based on experience. Brentano hoped to use experience to construct a core of generally accepted truths. His approach appears similar to that of his rival, Wundt, but with important distinctions. First, for Brentano, the truth and acceptability of his psychology would be determined by careful, logical examination. Experiences, which provide the empirical base of psychology, had to be analyzed according to the rules and principles of logic before they could be used to establish psychological knowledge. Wundt's inductive psychology, on the other hand, gave experimental results central importance.

A second major distinction between Wundt and Brentano concerns the modifiability of their respective systems. Since the empirical observations which Brentano's psychology was based on would not change, and since the rules of logic are fixed, Brentano did not expect his psychology to change much over time. It was, relative to Wundt's psychology, fixed. Consequently, it is no surprise that Brentano chose not to write the three additional outlines of his position that he had originally planned to follow his first book. In 1874, his psychology was complete. In contrast, the prolific Wundt constantly revised and expanded his books as new experimental findings became available.

Third, Brentano's psychology is an *act psychology.* Instead of studying the products of our mental actions, Brentano proposed that psychologists should study the mental actions and processes themselves. The three fundamental classes of mental acts Brentano proposed included ideating, judging, and loving versus hating. According to Brentano's analysis, mental acts may include as their objects past sensations, thus making it possible to have an idea of an object when the object is not present. The mind employs what Brentano termed *imagination,* or what Locke had termed *reflection.* Similarly, it is possible to feel an emotion when the object of that emotion is not present. In Brentano's system, one mental act may have as its object another mental act. We have ideas about ideas, judgments of judgments, and feelings about feelings. Finally, mental acts may mix; one mental act may have as its object a mental act of a different class. When we hear a harmonious sound or see a beautiful landscape, we feel pleasure. The pleasure, according to Brentano, results from the mental acts of seeing and hearing, not from the sensations themselves.

A fourth major distinction between the psychologies of Wundt and Brentano concerns methodology. Brentano's psychology did not include introspection, a method Brentano labeled "inner observation." While we are able to observe external objects, Brentano believed it is impossible to make inner observations of our own consciousness. Brentano pointed out that in the white heat of rage or in the throes of terror, we cannot observe these emotions. If we try to do so, the very act of observing changes, diminishes, or even destroys them. As further evidence that introspection is not an appropriate method for psychology, Brentano cited the Wundtians' descriptions of the long and arduous training program needed before a psychologist could qualify to introspect; the difficulty of such self-observations; and the rigidly controlled, unnatural conditions under which introspections were to be made. Brentano asked why, if inner observations are as natural as external observations, such extreme precautions and procedures are necessary. With sympathy and humor, Brentano described the sorry plight of students attempting what he considered the impossible:

> I know of examples of young people, desiring to devote themselves to the study of psychology, who, at the thresholds of the science, began to doubt their own ability. They had been told that inner observation is the main source of psychological knowledge, and they repeatedly made strenuous attempts at it. But all these efforts were in vain; all they got for their trouble was a swarm of confused ideas and a headache. So they came to the conclusion that they had no capacity for self-observation, which is quite right. But on the basis of the notion, which had been imparted to them, they took this to mean that they had no talent for psychological investigation. (Brentano, 1874/1973, p. 30)

If we reject introspection, what methods can psychology use to observe mental phenomena? Brentano suggested that mental acts can be observed in memory and therefore can be studied "quietly and empirically." We can look back, for example, at the last time we were angry and thus observe the mental phenomena involved in that emotion. As a second psychological method, Brentano proposed imagination. It is possible to intentionally arouse various mental phenomena for study. In addition to these two methods, Brentano suggested studies of the mental lives of animals and children as well as examination of the disordered mental lives of idiots and the insane. These suggestions anticipated the concerns of later comparative, developmental, and clinical psychologists.

Brentano in Perspective

Nearly twenty years elapsed between Brentano's publication of his *Psychology* and that of his next psychological works. These were years in which he suffered ill health, progressive loss of vision, and personal difficulties after he married in 1880. Former priests were forbidden to marry in Austria; as a result of his marriage, Brentano was forced to accept a lower-ranking position at the University of Vienna. In 1895, following his wife's death, he resigned from the faculty of the University of Vienna and moved to Florence. That same year Brentano published three psychological papers on optical illusions, and in 1896 he attended the Third International Congress of Psychology, where he presented a paper on his doctrine of sensation. At that time, his interests were becoming more philosophical, though he did attend the Fourth International Congress of Psychology in 1905, presenting a paper on the psychological qualities of tones. When Italy entered World War I in 1917, Brentano, an avowed pacifist, felt compelled to move to neutral Switzerland. He died in Zurich in 1917.

As we have seen, perhaps one reason Brentano is not as well known as Wundt or Ebbinghaus is that he was not a prolific writer. His lifetime bibliography consists of only thirty-eight works, of which perhaps eight are on psychological topics. He always considered his *Psychology* to be his major statement, and forty years after its publication he was still working on a proposed second edition, which was finally published posthumously in 1924 (Kraus, 1924). Brentano's significance for the history of psychology lies not in the number of his published works and certainly not in his experimental research, for he did very little, but rather in his formulation of a contemporary rival approach to that of Wundt. His psychology of *mental acts* was an important historical predecessor of the American *functional psychologies* that we will present in Chapter 10. Brentano also trained two important students: Christian von Ehrenfels, whose conception of form quality (Gestaltqualität) influenced the Gestalt psychologists (Chapter 7), and Carl Stumpf.

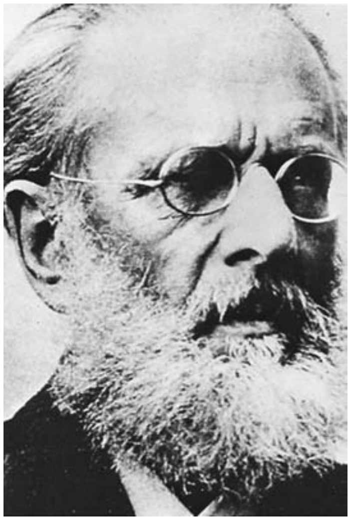
CARL STUMPF (1848–1936)

Carl Stumpf was born in Wiesentheid in Franconia, now Bavaria, southern Germany, on Good Friday 1848. He died on Christmas Day 1936. Stumpf's father was the country court physician, and his immediate family included scientists and academicians. As a boy, Stumpf showed precocious musical talent, learning the violin by the age of 7 and five other instruments by the age of 10 with sufficient skill to perform in public. At the age of 10, Stumpf composed and published an oratorio for three male voices, and throughout his life he composed and performed musical works (Ruckmick, 1937, p. 189). In his adult years, Stumpf moved equally comfortably in the academic world of psychology and the artistic world of music and musicians. At the University of Berlin, Stumpf valued his association with the great sensory physiologist Hermann von Helmholtz as well as his friendship with the famous violinist Joseph Joachim, who was a friend of Mendelssohn, Brahms, and Schumann. Later in his life, this musical background provided Stumpf with a frame of reference for evaluating psychological research on auditory perception and especially on musical aesthetics. It also led to disputes with the experimentally oriented Wundt, whose methods Stumpf would come to label "repellent" and whose name would become taboo in Stumpf's Berlin Psychological Institute.

As a boy, Stumpf attended the local *Gymnasium* before enrolling at the age of 17 as a student at the University of Würzburg. He spent a semester studying aesthetics and one studying law, the latter to prepare for a money-making career, since he did not consider himself sufficiently talented to be a professional musician. In his third semester at Würzburg he met the man who was to change his life, Franz Brentano. Brentano taught the artistically inclined Stumpf to think logically and empirically. After two semesters, Brentano encouraged Stumpf to transfer to the University of Göttingen to complete his studies under Rudolph Hermann Lotze (1817–1881), a German perceptual theorist. Even though Stumpf studied under Brentano for just three semesters, all his life he acknowledged his indebtedness to Brentano and regarded him as his master. After receiving a degree from Lotze in 1868, Stumpf returned to Würzburg to prepare for the Catholic priesthood. In 1869, he entered a seminary and studied theology, paying special attention to the writings of Saint Thomas Aquinas. Almost immediately the crisis over papal infallibility caused him to discard the black robe of the seminarian. However, unlike Brentano, he did not leave the church, and he remained a practicing Catholic until 1921.

Stumpf's Early Academic Career

Lotze welcomed Stumpf's decision to leave the seminary and arranged for him to return to Göttingen as an instructor in the Department of Philosophy. There



Carl Stumpf.
(Archives of the History of American Psychology)

Stumpf met Weber and Fechner and had the distinction of serving as an observer in psychological experiments for both of them. Weber demonstrated sensory mapping on Stumpf's arm and tested him as a subject in an experiment involving sensory magnitude estimation. At that time, Fechner was investigating the visual appeal of rectangles with different proportions. As we saw in Chapter 1, Pythagoras and his followers believed that beauty inheres in simple ratios: a lute string divided into exact divisions of 2, 4, 8, and so on, produces harmonious notes; when it is divided at other places, the notes are discordant. Similar principles were held to govern other aesthetic experiences. Thus, it was believed that rectangles having simple ratios of width to length—1:2, 2:3, 3:4, for example—would be most appealing to the eye of an observer. Fechner constructed ten rectangles with different ratios of width to length and asked a number of observers, including Stumpf, to choose the "best" and "worst." The rectangles chosen as "best" by the largest number of observers had a ratio of 0.62. This modal ratio falls between 3:5 and 5:8 and is not a simple ratio. It came to be known as the "golden section," that is, the ratio of a rectangle's width to length most pleasing to the eye. This careful approach to a problem of aesthetics appealed to the young Stumpf and reinforced the lesson he had learned from Brentano that psychological acts or functions can be studied empirically.

In 1873, at the age of 25, Stumpf returned to the University of Würzburg, this time as a professor in the Department of Philosophy. His homecoming, however, was not without problems. Upon arrival at Würzburg, Stumpf found that he *was* the Department of Philosophy. With Brentano's forced departure, the department had fallen on hard times, and Stumpf had to teach *all* philosophy and psychology courses. Even so, during this first year at Würzburg, Stumpf was able to complete his first major psychological work, an examination of visual perception, particularly depth perception.

Stumpf proposed a *nativistic* explanation of depth perception, in contrast to such empiricist theorists as Berkeley, Helmholtz, Wundt, and Stumpf's teacher, Lotze. These empiricists considered depth perception an acquired skill based on experience. Stumpf acknowledged the arguments they proposed but developed counterarguments in favor of his nativist position. He accepted that muscle and other sensations associated with eye movements, what Lotze had called "local signs," contribute to depth perception, but in contrast to Lotze, Stumpf felt they were of secondary importance. He stressed that they were only local, after all, and that something more must be involved. The "something more" was the interpretative action of a higher center in the brain. Furthermore, Stumpf considered the cognitive act of interpretation an inborn or native function. He compared local signs to addresses on letters: they are important, but the letters would not be delivered without the carrier's knowledge of the route. Stumpf's conception of depth perception paralleled Immanuel Kant's view of the presumptive nature of space. Stumpf's book has been cited as a testimonial to his youthful brilliance (Langfeld, 1937, p. 319) and an outstanding early contribution to the debate between the *nativist* and *empiricist* views of perception, a debate that continues in our time (Gibson, 1977).

Stumpf Gains Academic Prominence

In 1875, Stumpf began his monumental *Tonpsychologie* (Tone Psychology), a work often considered his greatest contribution to psychology. Stumpf followed Brentano's lead and distinguished between phenomena and mental functions. Stumpf suggested that phenomena such as tones, colors, and images are either sensory or imaginary. The study of such phenomena Stumpf termed *phenomenology;* his massive *Tone Psychology* was a phenomenology of tones. The second major class of psychological experience included seeing, hearing, perceiving, and thinking—Brentano's cognitive acts. Studies of sensory and imaginal phenomena were for Stumpf "preparatory" to the real task of psychology—the study of psychological acts or functions. But here we find a paradox, for Stumpf devoted his life to studying these preparatory phenomena but always considered himself a psychologist. Accepting his own distinctions, he was, in fact, a phenomenologist. Regardless of his academic label, Stumpf did a wide range of studies of the phenomenological characteristics of the sounds of different instruments, the determinants of melody, tonal fusion, and the consonance and dissonance of tones. He also investigated auditory attention, analysis, and comparison and conducted studies of a number of extremely unmusical subjects by comparing their musical observations and perceptions with those of musical people. These were monumental investigations, and they continued to the end of his career.

In 1879, as a result of this work, Stumpf was called to the University of Prague. The first volume of his *Tone Psychology* appeared in 1883. One year later, Stumpf moved to the University of Halle, staying there until 1889, when he was called to the University of Munich. Finally, in 1894, Stumpf's academic pilgrimage ended with his appointment to the most prestigious position in German philosophy, the chair of philosophy at the University of Berlin. Berlin was the capital city of Germany, the home of the kaiser and his court, and its university was one of the finest in Europe.

From our perspective early in the twenty-first century, we may wonder why Stumpf was appointed rather than Wundt or Ebbinghaus. After all, by 1894 Wundt was well-established as the leader of the new German psychology of mental content; he had published extensively and had established the world's leading psychological laboratory at Leipzig. Ebbinghaus's research on memory had been widely acclaimed, and he was also at the University of Berlin at that time. Perhaps he was considered too junior for a Berlin chair. In addition, Ebbinghaus might have harmed his chances for the chair with his criticisms of the eminent Berlin methodologist Wilhelm Dilthey. Dilthey was a skeptic regarding the new experimental psychology and believed that it would never be a true science. Ebbinghaus characterized Dilthey as having an old-fashioned understanding of science.

At Berlin, Stumpf also held an adjunct appointment as director of the Institute of Experimental Psychology at Berlin. The Institute, started by Ebbinghaus, occupied only three dark rooms at the time of Stumpf's appointment. Under his leadership, it expanded in 1900 to occupy the top floor of a Berlin apartment house, and in 1920 it was moved to twenty-five rooms in the former Imperial Palace. One of the great attractions of the University of Berlin was its proximity to the kaiser. Stumpf's psychological institute occupied part of the kaiser's former residence, a grand location that was appropriate for Stumpf's conception of psychology as a respectable experimental science.

Especially in the years prior to World War I, Stumpf held a position of great power and influence. He organized divisions within the Institute devoted to medical, musical, and military purposes in addition to the basic research division. In 1896, he took charge of preparations for the Third International Congress of Psychology held in Munich. Stumpf presided over the Congress and delivered the inaugural address on the relation between mind and body. He advocated an interactionist position, which he contrasted with the psychophysical parallelism held at the time by most nineteenth-century physiological psychologists, including Wundt. In 1899, Stumpf first presented his cognitive-evaluative theory of emotion as an alternative to the James-Lange theory (Chapter 9). Reisenzein and Schönpflug (1992) describe Stumpf's theory as a direct precursor of contemporary cognitive theories of emotion.

The year 1900 was a productive one for Stumpf. He established an archive of phonograph records of songs, music, and native dialects from all over the world. German missionaries, travelers, and diplomats sent recordings to Berlin. During World War I, a commission arranged to make recordings of the language, songs, and music of thousands of prisoners of war held captive in Germany. In addition to establishing this musical archive, Stumpf and a Berlin school principal cofounded the Society for Child Psychology in 1900. Their research organization was founded just one year after Binet had organized the Free Society for the Psychological Study of the Child in Paris (Chapter 11). Both societies supported studies of children, especially children's mental life. Stumpf's former teacher, Brentano, had also advocated such studies. Stumpf made observations of speech development in his own children as well as in others and studied the origins of childhood fears. He stressed the importance of directly observing children rather than using questionnaires, an approach which G. Stanley Hall had pioneered in the United States and which was then in vogue (Chapter 9). Finally, Stumpf studied the musical development of a number of child prodigies as well as children with phenomenal memories.

Stumpf served as the rector of the University of Berlin from 1907 to 1908, important recognition for a psychologist. Those years were a time of political turmoil and student unrest in Germany. In his inaugural address, he advocated a rigorous, observational approach to the acquisition of knowledge. He distrusted armchair speculations and theorizing. "Theories," Stumpf said in his autobiography (1930), "come and go." He cited as a source of satisfaction in his own life that he had made "some good observations." Paradoxically, Stumpf never conducted large-scale experiments. He was more in the mold of his teacher, Brentano, than in that of his rival, Wundt.

Stumpf Studies Sensational Phenomena

In 1903 and 1904, Stumpf was involved in two well-publicized debunking episodes. The first concerned an engineer from Prague who claimed to have invented a machine that could change photographs of sound waves into sound. The entire faculty at Berlin, together with many distinguished experts, attended an apparently successful demonstration. Stumpf, however, was convinced that the demonstration had been fraudulent and wrote a sarcastic article challenging the likelihood of such a machine. No one heard a single word about this remarkable invention ever again.

The second debunking was more difficult. The late nineteenth century saw much interest in the mental abilities of animals, an interest stimulated in large part by Charles Darwin's *The Descent of Man* (1871) (Chapter 9). As Darwin presented the case for continuity in the mental life of humans and other animals, researchers eagerly sought evidence of reasoning and thought in animals. With the long European tradition of dressage, intelligent horses were especially popular. The horse Muhamed was part of a stable of horses in Elberfeld, Germany, trained and owned by Karl Krall. While blindfolded, Muhamed could add, subtract, multiply, divide, and calculate square roots, tapping out the correct answer with his right foot. Scientific observers were never able to prove trickery or fraud.

The case of Clever Hans, an apparently brilliant horse owned by Herr von Osten, was even more sensational. Von Osten was a former high school mathematics teacher, a dabbler in phrenology, something of a mystic, and a man who was convinced that horses are capable of "inner speech" and therefore of mathematics. To all appearances, von Osten was successful in training Hans to add, subtract, multiply, divide, work with fractions, and even tell time and keep track of the calendar. For instance, von Osten might ask Hans, "If the eighth day of the month comes on a Tuesday, what is the date of the following Friday?" Hans would answer by tapping the answer with his hoof, slowing down as he approached the correct number. Hans could also count objects or people. Von Osten might ask, "Hans, how many people [or men, or umbrellas, or women] are there in this room?" Such questions might be asked orally or printed on cards. Von Osten exhibited Hans throughout Germany, never charging admission to his demonstrations but garnering great public interest wherever he went. Kaiser Wilhelm himself observed Hans, and a front-page account of the horse's mathematical abilities appeared in the *New York Times*. In his fore-

Clever Hans demonstrates his "mathematical abilities."
(Karl Kroll, Denkende Tiere, *Leipzig, 1912)*

word to an account of the investigation of Hans, American psychologist James Angell (Chapter 10) summarized the situation:

> No more remarkable tale of credulity founded on unconscious deceit was ever told, and were it offered as fiction, it would take high rank as a work of imagination. Being in reality a record of sober fact, it verges on the miraculous. After reading Mr. Pfungst's story one can quite understand how sedate and sober Germany was for months thrown into a turmoil of newspaper debate, which for intensity and range of feeling finds its only parallel in a heated political campaign. (Angell, in Pfungst, 1911, p. v)

Because of the immense public interest in Hans and his achievements, the German Board of Education appointed a commission to evaluate von Osten's claims. Stumpf was asked to head the commission and select its members. He included a circus manager, a cavalry officer, an experienced veterinarian, a number of schoolteachers, the director of the Berlin Zoological Gardens, and his assistant, Oskar Heinroth, whose student, Konrad Lorenz, was to win the 1973 Nobel Prize for his studies of animal behavior. This commission observed von Osten's demonstrations and in September 1904 issued a report concluding that no tricks, intentional influences, or aids from the questioner were involved in Hans's performance. They recommended further investigation to determine how clever the horse actually was. These investigations were conducted by one of Stumpf's assistants at the Berlin Institute, Oskar Pfungst (Pfungst, 1911).

Pfungst was able to befriend both von Osten and Hans, which was no small achievement since von Osten was of a tyrannical temperament and was prone to rage when the horse did not perform well. Hans, too, was bad-tempered and at times difficult to control. When frustrated, Hans made the stable courtyard an unsafe place, and Pfungst suffered more than one horse bite during his investigation. He tested Hans when the questioner knew the correct answer to the question and then when the questioner did not know the answer. Pfungst chose a seemingly simple test for a horse of Hans's talents: he printed numbers on cards, and asked Hans to tap out the the number shown. When von Osten asked the questions "with knowledge," 98 percent of the horse's responses were correct; "without knowledge," only 8 percent were correct. Clearly the questioner's knowledge was crucial, but how did it influence Hans's behavior?

First, Pfungst investigated the role of visual cues. Hans was fitted with large blinkers and was questioned with the questioner standing either directly in front of him, where Hans could see him, or to the side, where the horse could not see him. When the questioner stood to the side, Hans made strenuous attempts to see him and answered the questions correctly only 6 percent of the time. When the questioner stood directly in front of Hans, the horse got 89 percent of the answers correct. Clearly the horse required a visual cue from the questioner. With what Stumpf called his "keen eyes and iron patience" (Stumpf, 1930, p. 407), Pfungst was able to discern that when the horse was given a problem, the questioner would lean forward to watch the response being tapped out. At the correct response, Pfungst observed that the questioner would give an involuntary slight upward movement of the eyebrows and head. Nearly all the questioners made this movement, and they were all unaware of it. Once this cue had been identified, Pfungst was able to elicit any response he wanted simply by making the upward movement. Pfungst presented his evidence to Stumpf's commission, and in December 1904 a second report was issued concluding that the horse had learned to attend to slight changes in the questioner's body posture while tapping. The case of Clever Hans showed the critical influence of subtle cues and movements an observer might provide. It alerted psychologists to the need to control such effects and is still cited in discussions of the methodology of psychology. Von Osten forbade further studies with Hans, asserting that the investigation had failed to achieve what he considered its goal of corroborating his claims and theories. He continued to exhibit Hans, attracting large and enthusiastic crowds.

Stumpf's Later Years

The case of Clever Hans was one of Stumpf's more colorful investigations, but the bulk of Stumpf's later academic career did not consist of such sensational and interesting research. In fact, his later years were sad ones. With the outbreak of World War I, most of the young people had left the Institute of Experimental Psychology to serve in the armed forces, and so it was a lonely and deserted place. The war was a wrenching experience for Stumpf, since he had many British, American, and Russian psychologist friends and had been honored by his membership in the American Academy of Sciences and the National Institute of Music in Moscow. War between his beloved Germany and the allied countries disrupted these professional relationships. Compounding his sense of loss, he was asked by the German government to organize psychologists in support of the war effort. It appears that his heart was not in the assignment, and he admitted his work met with little success.

Stumpf retired from the University of Berlin in 1921 and was succeeded as director of the psychological institute by his former student, Wolfgang Köhler (Chapter 7). The last fifteen years of his life were a time of great social and political turmoil in Germany. The kaiser was in exile, and the country was wracked by inflation. In August 1922, 400 marks bought one U.S. dollar; one year later, in August 1923, the exchange rate was 1 million marks to the dollar (Rhodes, 1986, p. 16). Even so, one of Stumpf's former students, Kurt Lewin (Chapter 7), recalled that as an old man in his eighties, Stumpf would often visit the Berlin Psychological Institute to see the elaborate machines and instruments he had constructed (Lewin, 1937, p. 190).

Not only did the onset of World War I create a sense of personal sadness, conflict, and loss for Stumpf, it also might have been one of the reasons why much of his work was lost to the mainstream of sensory psychology. Stumpf made potentially major contributions to the field of auditory perception and to aesthetics, but his work was not elaborated by later generations of psychologists, particularly American psychologists, because their contact with Stumpf and his work had been severed. This unfortunate situation did not affect Stumpf only. The ideas of other German psychologists, such as Külpe and his students, suffered a similar fate.

OSWALD KÜLPE (1862–1915)

Oswald Külpe was born in 1862 to a German family in the Baltic province of Latvia. After graduating from the local *Gymnasium*, Külpe entered the University of Leipzig in 1881. He majored in history but became interested in psychology after attending Wundt's lectures. He spent two semesters at Leipzig and then, at Wundt's recommendation, transferred to the University of Göttingen to study under Georg Elias Müller (1850–1934). Müller had succeeded Lotze (Stumpf's teacher) at Göttingen and occupied the university's chair of psychology for over forty years.

Külpe's teacher was ardently dedicated to the new experimental psychology. The British psychologist Charles Spearman, who also studied with Müller, described him as having "a narrow outlook" and as being a man "who ran in blinkers" (Spearman, 1930, p. 305). Müller's vision might have been narrow, but his research output was broad. Initially, he followed Fechner's lead and worked on psychophysics, but like Ebbinghaus, he eventually turned to the study of memory. Müller began the search for the totally meaning- and association-free nonsense syllable. He also developed additional experimental procedures using nonsense syllables presented on memory drums. Müller pointed out a weakness in Ebbinghaus's experiments; Ebbinghaus had one person, most often Ebbinghaus himself, act as both experimenter and subject. Ebbinghaus had found that problem "vexing" and had taken precautions to avoid what he called "the secret influence of theories and opinions." As far as possible, Ebbinghaus withheld knowledge of the outcome of his experiments until they were complete, and he always replicated his results. But Müller's forceful criticisms were important in bringing potential experimenter influences to the attention of experimental psychologists. Today, psychologists pay much attention to what they call the "demand characteristics" of experiments, that is, to the subject's perceptions of the experimenter's expectations. Müller studied effective ways of learning and described the effects of interference—old learning interfering with new learning (Müller & Pilzecker, 1900). He also reported experiments in which memory was much better after a two-day interval, presumably as a result of the longer time available for its consolidation. In 1897, with another of his students, Adolph Jost, Müller also discovered that when two associations are of equal strength, repetition strengthens the newer one more than the older one, a finding known as *Jost's law.* Finally, Müller studied the phenomenal ability of "lightning calculators," individuals who could do large, bulky calculations nearly instantaneously. Despite this important work, Müller was never a popular figure. He apparently had a terrible temper and was often a vicious reviewer of the work of others.

After graduating from Göttingen, Külpe returned briefly to Russia, where he considered becoming a schoolteacher. However, he quickly returned to Germany to study under Wundt, receiving a Ph.D. in 1887. James McKeen Cattell (Chapter 4) had just left Leipzig for Cambridge, so Wundt appointed Külpe in his place and secured Külpe's appointment as a private tutor at Leipzig. Külpe was promoted to the rank of *Professor extraordinarius* in 1894, but that same year he moved on to the University of Würzburg. There Külpe and his students performed experiments that challenged fundamental assumptions held by Wundt and especially by Titchener. Despite this apparent rivalry, Külpe maintained the warmest affection for Wundt, always regarding him as his "master teacher," and was active in the publication of Wundt's *Festschrift* (honorary anthology).

Because the faculty needed a text for the increasingly popular lectures on psychology being given in the Leipzig psychology department, Wundt encouraged Külpe to write a book that was clearer and simpler than his own *Physiologishe Psychologie.* Wundt's text was in its fourth edition at the time, but it was too long, difficult, and technical for the students. In response to Wundt's request, Külpe published in 1893 one of his major works, the *Grundriss der Psychologie.* An English translation by Titchener, entitled *Outline of Psychology,* appeared in 1895. The book was dedicated "To my revered teacher, Wilhelm Wundt, in sincere gratitude and affection." Ironically, Wundt found the text unsatisfactory, and in 1896 he published his own, *Grundriss der Psychologie.* It is always difficult for a pupil to present a teacher's views, but there were other reasons for Wundt's dissatisfaction. Külpe's conception of psychology was beginning to diverge from that of Wundt.

Külpe Defines a General Experimental Psychology

In formulating his definition of psychology, Külpe was influenced by the positivist views of physicist Ernst Mach (1838–1916) and philosopher Richard Avenarius (1843–1896) (Danziger, 1979). As *positivists,* these philosophers held that all science is based on experience; when natural scientists observe and record natural events, they do so through their sensory experiences. When experiences are studied independently of a biological system, the science is physics; when they are studied in the context of a biological system, the science is psychology. The positivists' emphasis was on observation; mentalistic conceptions and attributions of mental entities were to be avoided. Psychology was to provide objective descriptions of mental events. These men accepted the possibility of a science of psychology and respected its status as a new but nonetheless valid and important branch of natural science. Külpe aimed to develop a positivistic general psychology that would include complex phenomena such as thinking, judging, remembering, and doubting. Despite Ebbinghaus's success, it was still Külpe's task to demonstrate that other higher mental functions could be studied experimentally. Külpe's research at Würzburg provided that demonstration and formed a foundation for contemporary cognitive psychology (Humphrey, 1951).

Research at the University of Würzburg

Külpe was assigned one of the university's medieval buildings for his laboratory, which was supported by a private endowment. By 1896 the laboratory was full of activity. The experimental results reported from Würzburg would challenge some of the fundamental tenets of Wundt's psychology and establish a rival approach to the science of psychology. What has come to be known as the "Würzburg school" saw its formal beginning in 1901 with a paper by two of Külpe's students, August Mayer (1874–1951) and Johannes Orth (1872–1949). In an investigation of the qualitative nature of associations, they questioned subjects about the associations that came freely to their minds during thinking. This method of questioning or interrogation was known in German as *Ausfrage* and came to be widely used at Würzburg. Mayer and Orth's subjects reported many different patterns and types of associations. The associations were complex and detailed, unlike those reported by Wundt and Titchener. They were more like Francis Galton's descriptions of the associations that came to his mind during his walk down Pall Mall in London (Chapter 9). Külpe was familiar with Galton's investigation and presented it in his *Outline of Psychology.* Such experiments would never have been done at Leipzig or Cornell.

In 1901, an experiment reported by Karl Marbe (1869–1953) was to show even more clearly the characteristics of the Würzburg approach. For many years, Marbe had been a *Privatdozent* or private tutor at Würzburg, succeeding Külpe as head of the laboratory. Marbe performed an experimental study of judgment, in which subjects were asked to compare weights and judge them as heavier or lighter. Many weight-lifting experiments had been done before, they were, after all, a staple of the psychophysical laboratories. What was different about this experiment was an interest in the judgments themselves. Marbe's subjects were able to make correct judgments most of the time, but they were unable to describe how they made the judgments. Their introspections did not yield descriptions of the mental act of judging; judgments just came to their minds. They did have many sensations and images, as Wundt had said they would, but the sensations and images were not the judgments themselves. In the act of judging, various other states—doubt, hesitation, searching—occurred. These states Marbe termed *conscious attitudes* (Ogden, 1911, p. 9). They formed the background against which judgments were made; they attended upon judgments. Wundt's description of three basic elements of consciousness—sensations, images, and feelings—did not adequately describe the experience of Marbe's subjects.

In 1900, Külpe and one of his American students, William Lowe Bryan, conducted some abstraction experiments which show the Würzburg approach at its best. Bryan was well prepared to assist in these experiments. After attaining a master's degree in philosophy at Indiana University (1886), he went to Berlin, where he served as a subject for Ebbinghaus's memory experiments (Capshew & Hearst, 1980). He then returned to Indiana, establishing a small psychological laboratory in 1888, and took a Ph.D. degree with G. Stanley Hall at Clark University in 1892. After teaching again at Indiana University, Bryan returned to Europe in 1900 and studied with Pierre Janet (Chapter 8) and Alfred Binet (Chapter 11) before working with Külpe.[8] In Külpe and Bryan's experiments subjects were shown cards with nonsense syllables of various colors, letters, and arrangements. The card was shown briefly, and the subject was asked to observe it and report the color, form, or number of items on it. Külpe and Bryan found that with suitable instruction, their subjects would abstract a particular feature while remaining unaware of the other features. Sensations from the features alone were not sufficient to place them in the subject's mental experience (Ogden, 1951, p. 15). Külpe and Bryan believed that abstraction of the desired element was based on active mental acts they termed *apprehension.* Two simple demonstrations illustrate this phenomenon:

1. If a subject is shown a random arrangement of six letters of the alphabet and six numbers and told that they will be asked to recall the letters, they will be easily able to do so. But they will have difficulty recalling more than one or two of the numbers. The instruction caused the letters to be *apprehended.*
2. Read this sentence:

   Finished files are the result of scientific study combined with the experience of years.

   Count the number of *F*s. Most people *apprehend* three or four *F*s. Actually there are five.

As we have seen, one of the most frequently used paradigms at Leipzig was that of the simple reaction time. The Würzburg psychologists used the reaction-time paradigm to study volitional responses, when subjects have to make a particular response to a specific stimulus through an act of will. With practice, reaction times decrease and the subjects become less and less able to report an act of will prior to the response. For one thing, the reaction occurs so quickly that there simply is not sufficient time for introspection. This creates a problem, for how could a volitional act occur, as it obviously does, without it being part of the subject's mental experience?

Yet another Würzburg worker, H. J. Watts (1879–1925), seized upon this dilemma. First he introduced the new Hipp chronoscope, which allowed reaction times to be measured with far greater precision and accuracy. It was a technical contribution that the Wundtians welcomed. What they did not accept was his conception of the reaction-time response itself. Watts proposed this time be "fractionated" into four phases:

1. A preparatory period, in which the subject prepares for presentation of the stimulus
2. Stimulus presentation, in which the subject stimulus senses the subject

[8] In a characteristically acerbic sentence, Boring commented that, after his final return to Indiana, Bryan "lapsed into the presidency of Indiana University" (Boring, 1957, p. 543).

3. Striving for the response—the subject's mental act prior to the response
4. The response itself

Watts believed that the volitional act occurs in the preparatory period, when subjects accept and prepare for the task. When his subjects introspected during the preparatory period, they were always able to describe volitional acts or thoughts. The act of will was present for all reactions, but always in the preparatory phase.

For his dissertation research at Würzburg, Watts (1905) used a constrained association technique. Subjects were given a stimulus word and were asked to give its sub- or superordinate. For example, to the stimulus word *bird,* the subordinate might be *sparrow,* and the superordinate *animal.* Watts's subjects were able to respond appropriately with short reaction times and without conscious mental effort. The conscious work, Watts claimed, was done when the instructions were given and the subject accepted them. These mental attitudes or preparations Watts termed "instructions." They were seen as establishing in the subject a "set" to respond in a particular way. Narziss Ach, Külpe's assistant at Würzburg for fifteen years, showed the influence of a cognitive set in mental operations. When Ach's subjects were shown tachistoscopically the numbers 7 and 3, their response was almost always 10, despite the fact that they were not given specific instructions to add. Products of other arithmetical operations—4, 21, and 2.3—usually did not occur as responses. The subjects had a cognitive "set" to add rather than to perform other arithmetical operations. Contemporary cognitive psychologists use similar procedures in what Michael Posner labeled *Chronometric Measures of the Mind* (Posner, 1978).

In 1905, Narziss Ach (1871–1946) reported an investigation using what he termed *systematic experimental introspection* to analyze the mental processes by which subjects reach decisions. Ach found clear differences between his subjects that were consistent from problem to problem, leading him to classify his subjects into different "decision types." These experiments are very reminiscent of Binet's (1903) descriptions of reasoning and thinking in his two daughters: the cool, concentrated Madeleine and the impulsive, lively Alice (Chapter 11). When Ach published his results, a rather unseemly squabble resulted. Binet claimed priority and stated that the "method of Würzburg" was better named the "method of Paris." Priority was not really important; what was significant was that studies by Binet in Paris and in Külpe's laboratory were converging on the same findings (Ogden, 1911).

As the years passed, the experiments done at Würzburg became more and more cognitively oriented as they addressed increasingly complex mental activities. Some of the best known of these investigations were those of Karl Bühler. In 1907, he reported the results of an experiment in which subjects were asked questions that required a thoughtful reply rather than a simple reaction or a yes or no answer. For example, he asked: "Why is it that the smaller a woman's foot, the larger the bill for her shoes?" (Bühler, 1907, p. 298). Modern examples of Bühler-style questions might be: "Why is it that as school enrollments decrease, school budgets do not?" or "Why are utility-hole covers round?" or this amusing puzzle:

Two elephants are sitting on a log.
The little elephant is the big elephant's son,

but the big elephant
is not the little elephant's father.
How is that possible?[9]

The thought required for such problems was the subject matter of Bühler's research. He questioned his subjects in an empathetic but detailed way to tease out the mental steps they had followed. His subjects told him that the solutions usually came to them without concrete images or sensations. Consequently, Bühler described the thought of his subjects as being "imageless." In 1906 an American investigator, Robert Woodworth, had reported imageless thought, so the finding was not original with Bühler, but it did become a hotly debated topic between the Leipzig and Würzburg psychologists. The reality of thought without sensations and images was impossible according to Wundt, who believed that all the experiments done at Würzburg, especially Bühler's, were pseudo or mock experiments. Bühler was not using introspection correctly, since his subjects reported what happened as they tried to solve the problem rather than reporting the mental events themselves. Their data were "highly subjective" and thus subject to bias and error (Wundt, 1908).

A final challenge to Wundt came from Würzburg in 1915 by way of another American visitor to the laboratory, Thomas Verner Moore. Moore was an ordained priest who had earned a Ph.D. at Catholic University. At Würzburg he studied the relationship of meaning to image. Moore presented words both visually and auditorily to nine subjects and asked them to press a telegraph key as soon as the word evoked meaning or to lift their hands off the key when it evoked an image. For all but one of the nine subjects, meanings came more quickly than images. Meanings occurred within half a second on the average, while images took a second. Moore and Külpe concluded that meaning and image are distinct elements of mental experience and that there are thus at least four independent elements in human consciousness: sensation, image, feeling, and meaning (Ogden, 1951). After his work at Würzburg, Moore returned to Catholic University, where he served as chairman of the departments of psychology and psychiatry from 1939 to 1947. In 1938 Moore wrote *Cognitive Psychology,* a book that has much in common with the perspective that emerged twenty-five years later, at the beginning of what has been called the cognitive revolution in psychology (Knapp, 1985).

Würzburg Under Attack

The Würzburg research was criticized in much detail and with great frequency by Wundt and his students. Titchener was an especially assiduous critic. Külpe had been senior to him in the Leipzig laboratory and seems to have retained a rather paternalistic attitude toward Titchener throughout his life. Ogden recalled that Külpe once told him, "If only I could sit down with Titchener, I am sure I could make him see what we are driving at" (Ogden, 1951, p. 6). Külpe was never able to do so, and Titchener certainly never changed his mind. More than half a century later, when Titchener's student, Edwin Boring, discussed

[9] We assume that the "big elephant" is male. This big elephant is the little elephant's mother.

Külpe in his *History of Experimental Psychology*, we see those critical impulses still at work. Boring describes Külpe as a psychologist who, "with the impress of G. E. Müller and Wundt upon him, began as a psychologist of content, a clear thinker of succinct thoughts and a man ready to follow whither experiment led, and who ended up, after the researches of his Würzburg school of thought, pretty well over into Brentano's camp" (Boring, 1957, p. 386).

Külpe left Würzburg for the University of Bonn in 1909. In 1913 he made his last move, to the University of Munich. Külpe was deeply committed to an experimental approach to psychology and accepted these positions only on the condition that a laboratory be established at Bonn and an existing laboratory be reequipped at Munich. He often said that "science was his bride." However, like Stumpf, Külpe was an accomplished musician and had a deep interest in music as well as literature and art. One of his American students, Robert Ogden, described him as "an esthetic personality living in a factual world" (Ogden, 1951, p. 7).

World War I had a traumatic effect on Külpe, as it had on Stumpf. He had many psychologist friends in the allied countries yet was convinced of the rightness of Germany's cause. With his death in 1915, the research program at the Würzburg school ended.

THE LOST GERMAN PSYCHOLOGISTS

With the exception of Ebbinghaus, Weber, and Fechner, many German psychologists of the late eighteenth and nineteenth centuries fell into relative obscurity. As we have seen, the major reason for this was that World War I disrupted their work and international professional contacts. When Hitler and the Nazis came to power in 1933, the destruction of the German universities soon followed. Stumpf was the only German psychologist discussed in this chapter who was still alive at the time. He was a very old man but was keenly aware of the political situation. In one of his last letters to a former student, he wrote pathetically that he "was not a good enough philosopher to maintain a complete stoicism toward the existing conditions," yet he "was endeavoring to cultivate that attitude" (Langfeld, 1937, p. 319).

The political situation prevented communication between German and American psychologists. But, as we have already noted, these "other" German psychologists also did not have their loyal Titcheners to carry their theories and approaches to America. Consequently, many of their ideas were not given appropriate consideration or were simply lost. Moreover, the development of other approaches to psychology in America, such as functionalism and later behaviorism, served to displace the German cognitive approach. Today, cognitive psychologies with some similarities to those of Stumpf and Külpe are finally gaining a prominent position in American psychology (Knapp, 1986a). If it had not been for the two world wars, however, they might have developed much earlier. The only nineteenth-century German approach that did find a footing in America belonged to the Gestalt psychologists. Prior to the onset of World War II, these men fled from Nazi Germany and found refuge in America. Gestalt psychology will be our concern in Chapter 7.

Kurt Lewin.
(Archives of the History of American Psychology, (University of Akron)

CHAPTER 7

Gestalt Psychology in Germany and the United States

During the first decades of the twentieth century, *Gestalt psychology* provided a major alternative and challenge to *structuralism* (Chapters 4 and 5), *functionalism* (Chapter 10), and *behaviorism* (Chapter 12). Founded in Germany by successors to the psychologists discussed in Chapter 6, *Gestalt psychology* moved west in the 1930s and became an important influence on the development of American psychology. *Gestalt* is a German word that means "shape" or "form." Initially the three founders of *Gestalt psychology,* Max Wertheimer, Kurt Koffka, and Wolfgang Köhler, were interested in perception. Later their interests broadened to include learning, problem solving, and cognition. Kurt Lewin adopted a *Gestalt* approach in developing an innovative field theory, which he and his students employed to address a wide variety of topics and concerns in child development, industrial management, rehabilitation, and social psychology. The term *Gestalt psychology* has entered the English language, and the word *Gestalt* is widely used by psychologists, sometimes without being capitalized.

THE CONCEPTUAL FOUNDATIONS OF GESTALT PSYCHOLOGY

Though new and even radical, *Gestalt psychology* did not develop in a vacuum but rather grew out of the perceptual theories of Ernst Mach (1838–1916) and the experiments of Christian von Ehrenfels (1859–1932). In Chapter 6, we encountered Mach as a positivist philosopher and saw his influence on Oswald Külpe. In his book *Analysis of Sensations* (1886), Mach described the properties of spatial and auditory forms—squares, circles, and simple melodies. As perceptual wholes, these forms have qualities that distinguish them from their elements; sensations are organized in consciousness to create qualities of the form that may be novel and, to some extent, independent of the sensations themselves. Mach pointed out that a table is the source of many sensations; we can see, touch, and possibly even taste it. But a table is something more than a compounding of those sensations. It has a "form quality" that persists even when the sensations change. Brightly illuminated or dimly lit, new or old, polished or stained with ink, it remains the same table. The table's form qualities give it perceptual or psychological permanence.

Von Ehrenfels (1859–1932) received his training in philosophy under Alexius Meinong at the University of Gräz in Austria. Meinong had been a pupil of Franz Brentano (Chapter 6). Von Ehrenfels must have been an interesting person; he wrote poems and operas and was a passionate Wagnerian, a friend of Sigmund Freud (Chapter 8), and an advocate of the legalization of polygamy (Heider, 1970). He also had a strong musical background as both a composer and a performer. Von Ehrenfels agreed with Mach that melodies have *form qualities* in addition to the distinct sensations from the individual notes that constitute them. When a melody is played in different keys or played by different instruments, the different notes produce different sensations, but the melody retains its form quality. A song sung by different voices remains the same song. Von Ehrenfels termed this characteristic *transposability.* The melody may be transposed to different keys, voices, or instruments, but it still retains its identity. In 1888 and 1889, von Ehrenfels lectured on form qualities at the University of Vienna, and in 1890 he published a paper describing them. One of the students who heard him lecture and read his paper was Max Wertheimer, one of the three founders of Gestalt psychology.

MAX WERTHEIMER (1880–1943) AND THE BEGINNING OF GESTALT PSYCHOLOGY

Max Wertheimer was born in Prague. His Jewish family sent him to a Catholic *Gymnasium* but also taught him Hebrew and the *Torah.* For his 10th birthday, they gave him the philosopher Baruch Spinoza's collected works (Ash, 1995)! Perhaps Spinoza's insistence that all existence is embraced in one substance—God (or Nature)—influenced Wertheimer's intellectual development. Wertheimer attended the University of Prague, where he studied law. He then became interested in psychology and studied under Stumpf at the University of Berlin before taking his doctoral degree at the University of Würzburg with Külpe in 1904. His dissertation was a review of the research on the psychology of legal testimony. In the summer of 1910, Wertheimer was on his way from Austria to the German Rhine for a vacation. Gazing out of the train window, Wertheimer was struck by the apparent movement of poles, fences, buildings, and even distant hills and mountains. These stationary objects appeared to race along with the train. Millions of people before Wertheimer had ridden in trains and seen this phenomenon, but Wertheimer saw it with new eyes. He asked himself: Why do these objects appear to move? According to an anecdote Wertheimer liked to share with his students, he abandoned his vacation plans, left the train at Frankfurt, and bought a simple *stroboscope* in a toy store. In his hotel room, he used the stroboscope to project successive images of a horse and a child. At the right projection rate, the horse appeared to trot and the child to walk. Though these movements were jerky and spastic, they were clear. Many people before Wertheimer had seen such movements. The stroboscope with its series of images mounted on a wheel turned in a viewer, was after all a popular toy. Wertheimer sought the underlying psychological origins of such movement. Again he asked himself: Where does the movement come from?

The next day, Wertheimer consulted Professor Friedrich Schumann of the Psychological Institute at the University of Frankfurt. Schumann (1863–1940) held a Ph.D. in physics and was an authority on space perception. Unable to answer Wertheimer's questions, Schumann urged him to try to answer them himself and generously offered the use of his laboratory and equipment, including an improved *tachistoscope*[1] he had developed. Schumann also introduced Wertheimer to two of his Frankfurt colleagues, Kurt Koffka and Wolfgang Köhler. Koffka (1886–1941) was born in Berlin and attended the university there. He took a Ph.D. degree with Stumpf in 1909. Köhler (1887–1967) was born in Reval in the Baltic provinces (now Tallinn, Estonia) and also took a degree with Stumpf in 1909. When they met, Wertheimer was 30 years old; Koffka and Köhler were 24 and 22, respectively. They were to become the *triumvirate* of *Gestalt psychology.*

In his first experiment at Frankfurt, Wertheimer used the Schumann tachistoscope to successively project a vertical white stripe and then a horizontal white stripe on a black background. Schumann had reported in 1907 that at certain time intervals the white stripe appeared to move from the vertical position to the horizontal position. Wertheimer's three subjects[2]—Köhler, Koffka, and Koffka's wife—all described exactly that perceptual experience. One reported "rotation of about 90 degrees, it is impossible to think of it as a succession; it is not the white vertical that moves, but there is simply a process of transition" (Wertheimer, 1912, in Sahakian, 1968, p. 419). Another subject reported that the line appeared to "lie down" (Wertheimer, 1912, in Sahakian, 1968, p. 419). Apparent movement had been observed under controlled laboratory conditions.

Next Wertheimer shone lights successively through two narrow slits in a screen. When the lights were separated by intervals of 50 to 60 milliseconds, they appeared to move from one position to another, a phenomenon Wertheimer labeled the *phi phenomenon.* At shorter intervals, both lights were perceived as being on continuously; at longer intervals, they were seen successively; but at the optimum interval, Wertheimer reported that "the motion is present compellingly and characteristically in its specific nature; it is given clearly and spontaneously and is always observable" (Wertheimer, 1912, in Sahakian, 1968, p. 422). Wertheimer described the *phi phenomenon* as a psychological experience that is not reducible to its elements. Apparent movement is something more than the sum of the properties of the stationary lights. He had observed the phenomenon holistically in a small number of subjects. In these early experiments, we see a clear application of the four principles of Gestalt theory and research:

1. *Holistic thinking:* The whole is always more than the sum of its parts. This tenet of *supersummativity* was central to the *Gestalt* psychology.

[1] *tachistoscope,* n. An apparatus for use in exposing visual stimuli, such as pictures, letters, or words, for an extremely brief period, usually a tenth of a second (RHDEL, p. 1446).

[2] Wertheimer also tested a small number of neurological patients with occipital lobe impairments.

2. *Phenomenological basis: Phenomena* are the subject matter of psychology. Psychological analysis must proceed from phenomena to their essence.
3. *Methodology: Gestalt* psychology makes use of lifelike (reality) experiments with small numbers of subjects.
4. *Isomorphism*: Psychological processes are directly related to biological, especially brain, processes.[3]

An experiment reported by Vittorio Benussi (1878–1927) provides another example of apparent movement, but in a different sensory modality. Benussi was a contemporary of Wertheimer, a student of Meinong, and a professor at the University of Gräz. He discovered that when two points on the skin are stimulated in rapid succession (the interval is critical), the stimulus appears to move in an arc through space, touching the skin at the two stimulation points. It is as if a flea had hopped from one spot to the other. According to Benussi, perception of the movement of the "flea" is a two-stage process. First the tactile stimulus is sensed, and then an internal mental process occurs that results in the perception of movement. Benussi labeled this internal mental process *Gestalt* production.

Georg von Bekesy (1899–1972) won the 1961 Nobel Prize for his research on the mechanisms of hearing. In a later series of experiments, von Bekesy placed vibrators on the knees of blindfolded subjects. At certain vibration rates, they perceived a point of vibration jumping from one knee to the other—a *tactile phi phenomenon.* Von Bekesy also found that at certain rates, subjects would experience a point of stimulation in the space *between* their knees. They experienced a clear tactile sensation from a spatial location where there were *no* sensory receptors (Pribram, 1971, p. 169).

In 1972, two psychologists, Frank Geldard and Carl Sherrick, reported an effect similar to Benussi's. They found that when electrical and mechanical stimuli were applied at certain time intervals to separate parts of the wrist and arm, the subjects reported "a smooth progression of jumps up the arm, as if a tiny rabbit were hopping from wrist to elbow. If the original timing is retained and the number of taps (N) at each locus is reduced, the hops get longer; if N is increased (up to a limit), the hops become shorter" (Geldard & Sherrick, 1972, p. 178).

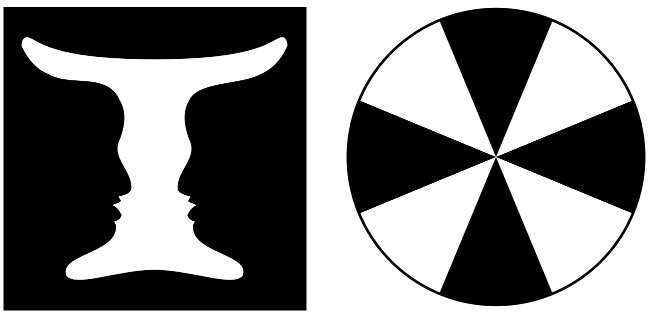
Clearly, in Wertheimer's and Benussi's experiments, and more recently for von Bekesy's subjects and in the case of Geldard and Sherrick's "rabbit," the *Gestalt,* or whole perceptual experience, had a property—movement—that its components did not. The lines, lights, and tactile stimuli did not actually move but were perceived to do so. In 1912, Wertheimer published a paper, *Experimentelle Studien über das Sehen von Bewegung* (Experimental Studies of the Perception of Movement), reporting the results of his experiments at Frankfurt. This paper marks the formal beginning of *Gestalt* psychology.

[3] In an unsuccessful attempt to show that visual perceptions and their assumed isomorphic "figure currents" in the brain could be disrupted, Köhler arranged for direct current to be sent through his brain. He stopped the experiment when "half of his visual field turned dark. For the next week he looked awful. He suffered from tremendous headaches and feared he had done some permanent damage to his brain. Eventually the pain subsided, and there were no further ill effects" (Wallach, 1976, p. 5).

Wertheimer, Koffka, and Köhler sought a newer, more dynamic psychology than Wundt's and especially than Titchener's structuralism. The *Gestalt* psychologists were dissatisfied with what they considered to be the static, sterile, and stilted state of psychology at that time. Later, Köhler recalled their views:

> His [the introspectionist's] psychology is quite unable to satisfy people for long. Since he ignores the experiences of everyday life, and concentrates on rare facts which only an artificial procedure can reveal, both his professional and lay audience will sooner or later lose patience. And something else will happen. There will be psychologists who will take him at his word when he says that this is the only right way of dealing with experience. If this is true, they will say, the study of experience can surely not interest us. We will do more lively things. We will study behavior. (Köhler, 1947, p. 85)

In doing "more lively things," Wertheimer, Köhler, and Koffka did indeed establish a new, more dynamic, more relevant psychology. In their outlines of *Gestalt psychology,* they mustered support for the new discipline wherever they could find it. Especially important was the research of Danish phenomenologist Edgar Rubin. In 1915, Rubin described his experiments with perceptually ambiguous figures such as those shown.



In the figure on the left, a person usually first sees a white table or urn (vase) and then, sometime later, two profiles in black. The figure therefore is described as "Rubin's vase" or "Rubin's Peter and Paul profiles." In the other figure, a person sees either a white cross or a black cross. In these figures different figure-ground relationships lead to different perceptions. These perceptions, said Rubin, emerge as wholes, not piecemeal. Such figures demonstrate that our perceptions are active, lively, and organized; we are not simply passive receivers of sensory stimuli. The *Gestalt* psychologists adopted such views as their own.

Gestalt Principles of Perception

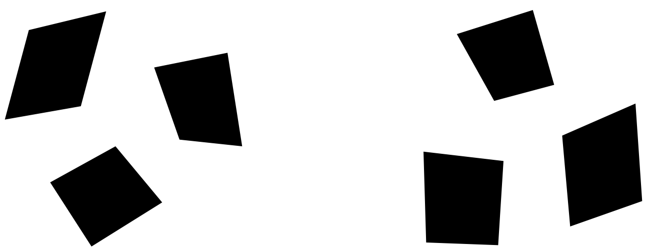
According to the *Gestalt* psychologists, our perceptions of the everyday world are organized actively into coherent wholes. Consider the night sky. For eons humans have perceived the stars in the night sky as belonging together in common groups that have names: the Big Dipper or the Southern Cross, for example. The principles that govern the organization of such perceptual experiences were outlined in three important works: Koffka's *Perception: An Introduction to the Gestalt Theory,* published in the *Psychological Bulletin* of 1922 and thus read by English-speaking psychologists; Wertheimer's *An Enquiry into the Laws of the Gestalt* (1922); and Köhler's *An Aspect of Gestalt Psychology* (1925). These principles included the following.

Similarity. Equal and similar elements form groups or wholes. Consider the following figures:

```
x  o  x  o  x  o        o  o  o  o  o  o
x  o  x  o  x  o        x  x  x  x  x  x
x  o  x  o  x  o        o  o  o  o  o  o
x  o  x  o  x  o        x  x  x  x  x  x
x  o  x  o  x  o        o  o  o  o  o  o
```

Typically, the Xs and Os in the array on the left are seen in columns, whereas they are seen in rows in the array on the right. We group elements that are similar into perceptual units—in this case, into either columns or rows.

Proximity. Elements that are close together tend to be grouped. In looking at the following figure, most observers perceive two groups of three patches:



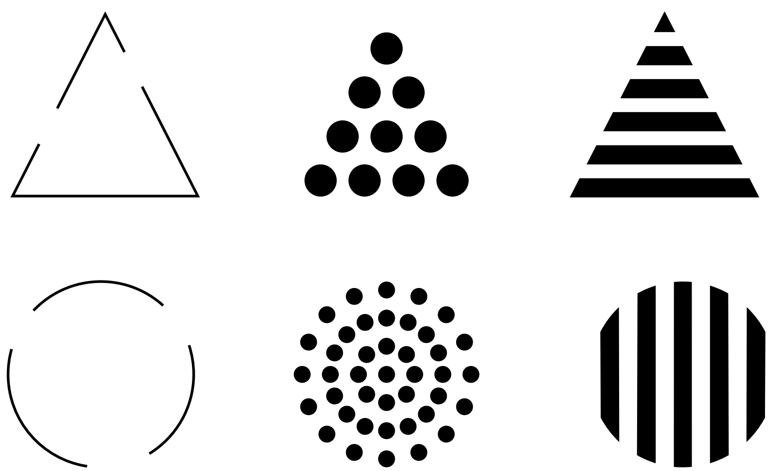
Xs and Os can easily be arranged to produce proximal grouping:

```
xx   xx   xx        oo   oo   oo
xx   xx   xx        oo   oo   oo
xx   xx   xx        oo   oo   oo
xx   xx   xx        oo   oo   oo
xx   xx   xx        oo   oo   oo
xx   xx   xx        oo   oo   oo
```

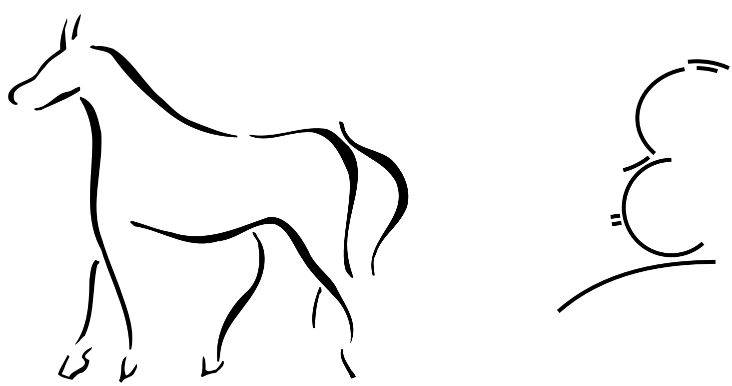
The array on the left is usually perceived as three double columns of Xs, whereas the array on the right is perceived as three double columns of Os. The Xs and Os in the following array are proximally grouped so that we perceive two squares:

```
x x x x x        o o o o o
x       x        o       o
x       x        o       o
x       x        o       o
x x x x x        o o o o o
```

Closure and Good Gestalts. Closure refers to our tendency to "fill in" or complete the missing parts of a configuration so as to make it perceptually complete. A figure that allows us to do this easily is a good *Gestalt.* Consider these examples:

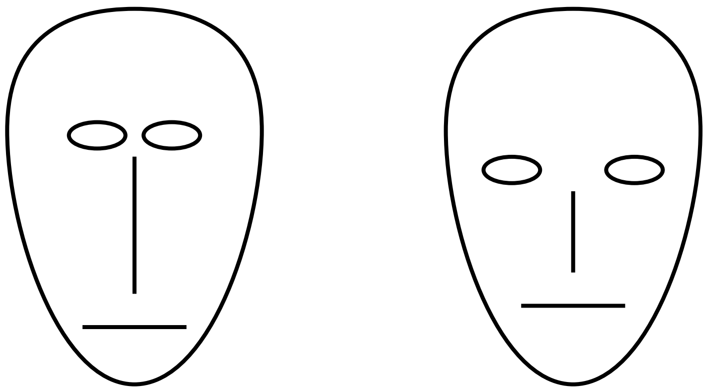


In all cases, the figures are incomplete—they lack closure—yet they are all clearly seen as either triangles or circles. These geometric figures are examples of good *Gestalts.* Often, because of closure, just a few lines are sufficient to form organized perceptions:



Most people easily see the horse in the drawing by Picasso on the left; the figure on the right may be less compelling. It is movie director Alfred Hitchcock's cartoon of himself. For those familiar with Hitchcock's profile (Spoto, 1983), the figure is clearly seen as the essential Hitchcock. These figures are good *Gestalts;* they have closure and balance to a sufficient degree that no local change could improve them.

In these demonstrations, the *Gestalt* psychologists showed that perceptual experiences are dynamic, not static; organized, not chaotic; and predictable, not erratic. Rudolf Arnheim considered the insight that "the world of sensory experience is made up primarily not of things but of dynamic forms" to have been the most important development in the psychology of the arts during the twentieth century (Arnheim, 1988, p. 585). To illustrate such perceptual dynamics, Arnheim described the different impressions these two simplified faces made on observers:



(Arnheim, 1988, p. 585, after Galli, 1964)

The face on the left is seen as aged, sad, and mean; the face on the right is seen as youthful and serene. Minor differences in the figures lead to major perceptual differences.

The *Gestalt* psychologists believed that principles of perceptual organization can account not only for our visual perceptions, but also for our auditory and tactile perceptions and for such higher mental processes as memory. Bluma Zeigarnik, Paul Schiller, and Roy F. Street have provided impressive demonstrations of the generality of these *Gestalt* principles.

The Generality of Gestalt Principles

Bluma Vul'Fovna Zeigarnik (1890–1990)[4] was a Russian psychologist best known to Western psychologists for her discovery of what has come to be

[4] Tamara Dembo informed Vladimir Sloutsky that Zeigarnik's husband was a supporter of the Communist party and insisted on their return to Russia. Later he was executed in one of Stalin's purges (Sloutsky, 2002). Bluma Zeigarnik had a long and distinguished career as one of the leaders of Russian psychology. She was a professor of psychology at Moscow State University and director of the division of abnormal psychology (Solso, 1987, p. 189).

called the *Zeigarnik effect* (Bieliauskas, 1977). Zeigarnik spent some time in Germany working with the fourth important *Gestalt* psychologist, Kurt Lewin. The genesis of her study was Lewin's observation that German waiters could remember for a considerable stretch of time the details of a customer's bill. However, once the customer had paid the bill, the waiters often could not recall the amount. As long as the bill remained unpaid, the transaction lacked closure, and this tension facilitated recall; payment completed the transaction, produced closure, dissipated the tension, and erased the memory.

To test the validity of this explanation, Zeigarnik (1927) did an ingenious experiment. She gave her subjects a series of 18 to 22 simple tasks, such as copying lines from a book, writing the names of cities whose names begin with the letter L, and making clay or matchstick figures. One-half of the tasks were interrupted by the experimenter before completion, and so lacked closure; the other half were completed. One hundred sixty-four subjects were tested. A few hours later, they were asked to list *all* the tasks they could recall. The subjects recalled the unfinished tasks 90 percent better than the completed tasks, and they also recalled the unfinished tasks more quickly and with less effort (Hartmann, 1935, p. 220).

Zeigarnik believed that a subject given a task feels a need to complete it. If he or she is not allowed to do so, the "quasi-need" persists, creating a state of tension, which in turn facilitates recall of that particular task. This explanation predicts that if the recall test were given twenty-four hours later, it would be much more difficult to recall the interrupted tasks. By that time, the quasi-need would have dissipated. Zeigarnik tested some of the subjects twenty-four hours after the interrupted or completed tasks and found that, by then, recall of the interrupted tasks was in fact considerably reduced (Köhler, 1947, p. 304).

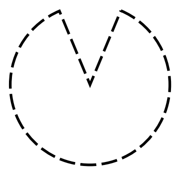
In our everyday world, we see compelling examples of the *Zeigarnik effect;* for example, the "cliff-hanger" endings of serial episodes and advertisements pose questions without answers, or set us up for closure and then fail to provide it. In 1980, the season of the television series *Dallas* ended without disclosing who shot J. R., leading to intense speculation and a *Time* magazine cover story asking that question. In 2002, I am informed by my students, the last episode of *Friends* ended with the character Rachel giving birth to a baby without having decided whom she would marry. Advertisements lacking closure make our brains itch (Chance, 1975). Some years ago, there was a particularly clever example of this technique in a Salem cigarette commercial played on radio and television. The commercial included a jingle: "You can take Salem out of the country but [here a bell rang]—*ting-a-ling*—you can't take the country out of Salem." The jingle was repeated several times, and then the commercial ended: "You can take Salem out of the country but—*ting-a-ling*. . . ." The need to complete the message was irresistible. It was a brilliant use of lack of closure to facilitate recall.

The copy of another effective advertisement read:

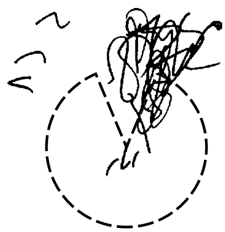
(—)ingle (—)ells
(—)ingle (—)ells
Your Xmas celebration is not complete without **J & B!** [whiskey]

In an entertaining paper, Hearst described the tension we experience during an unusually long silence in a conversation. He also pointed out that medieval cartographers added mythical or nonexistent animals to fill in blank or incomplete spaces in their maps (Hearst, 1991, p. 441).

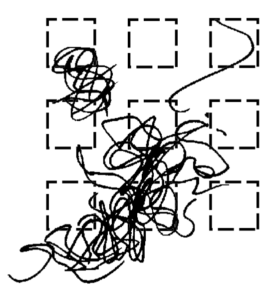
The second fascinating study of the generality of *Gestalt* principles took place at the Yerkes Regional Primate Center under the direction of Paul Schiller (1951). Schiller took advantage of the scribbling and drawing ability of a mature chimpanzee, Alpha. When given crayons and paper, Alpha would often draw. Schiller showed Alpha the following circle with a missing pie-shaped wedge:



Alpha filled in the open space and made few marks on the rest of the figure (Schiller, 1951, p. 106).

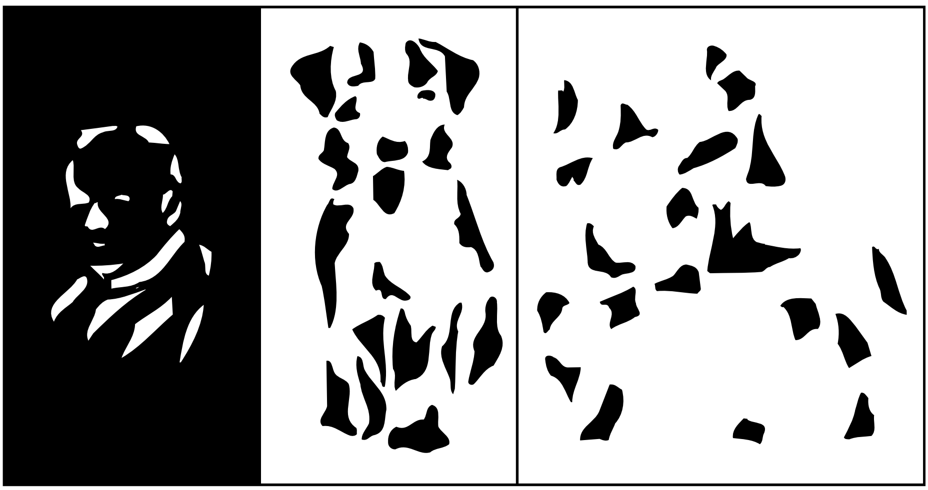


When Alpha was shown the following arrays of squares, most of the scribbles were in the area of the missing squares (Schiller, 1951, p. 107). Alpha's drawings were remarkably consistent with *Gestalt* principles of perceptual organization. Like Zeigarnik's subjects and anyone who experienced the Salem commercial, or like anyone who has tried to carry on a conversation with a diffident partner or felt the tension of an unfinished joke, Alpha expressed a need for closure.



In a reappraisal of three chimpanzees' drawings, Sarah Boysen and her colleagues at The Ohio State University found some empty-space-filling between widely separated components and reported that "some individual drawings were tantalizingly suggestive of marks 'intended' to complete the figure, and if limited samples were examined, they would suggest some purposive drawing" (Boysen, Berntson, & Prentice, 1987, p. 88). Nevertheless, closure was not part of the overall drawing behavior of their chimpanzees, possibly because theirs were younger than Schiller's animal.

Closure has also proved to be of clinical significance. *The Gestalt Completion Test* judges a subject's ability to perceive meaningful figures in drawings such as those shown here (Street, 1931).



The ability to see the "man," "dog," and "horse and rider" has been used to assess the functional integrity of the right hemisphere of the brain (Gur & Reivich, 1980). Poor performance on perceptual closure tests has been associated with right hemisphere impairment (Bogen, De Zure, Tenhouton, & March, 1972). More recently, perceptual closure tests have been characterized as "noisy"—that is, influenced by many factors—but they are still considered useful measures of right hemisphere function (Wasserstein, Zappullan, Rosen, & Gerstman, 1987).

Illusions and Our Perceptual World

According to *Gestalt* psychologists, our tendency to organize perceptions leads to a perceptual or psychological environment that is often very different from the physical one. Consider these simple figures:

In both cases, the vertical line appears longer than the horizontal line, but the lines are actually all equal in length. Here and in general, the physical and psychological worlds often do not correspond; our tendency to organize our perceptions leads to illusions, or deceptions of the senses. Consequently, when we react to the environment, we are not necessarily reacting to physical reality; we may be reacting to a different psychological reality. In *Principles of Gestalt Psychology* (1935), Koffka used an old German legend as a dramatic illustration of the difference between what he termed "geographic" and "behavioral" environments.

> On a winter evening, amidst a driving snowstorm, a man on horseback arrived at an inn, happy to have reached a shelter after hours of riding over the windswept plain in which the blanket of snow had covered all paths and landmarks. The landlord who came to the door viewed the stranger with surprise and asked him whence he came. The man pointed in the direction straight away from the inn, whereupon, the landlord in a tone of awe and wonder, said: "Do you know that you have ridden across the Lake of Constance?" At which the rider dropped stone dead at his feet. (Koffka, 1935, pp. 27–28)

Geographically, the man had ridden across the Lake of Constance, but *behaviorally* or *perceptually,* he had crossed a snow-covered plain. When he learned what his environment really had been, the shock killed him. Koffka also pointed out that though two of us may share the same geographic environment, our behavioral environments may be very different.

The Fate of Gestalt Psychology in Germany

These experiments and theoretical contributions established *Gestalt* psychology as a major school of German psychology in the 1920s. During that decade, Germany was a nation devastated by the aftermath of World War I with its 21 million battlefield casualties. After the war, Germany's political, economic, and social institutions were in disarray. In November 1918, riot and mutiny spread to Berlin, leading to the kaiser's flight to Holland, to the armistice, and to the founding, after more bloody riots, of the Weimar Republic. That republic underwent twenty-one changes of government from 1919 to 1933, ending with the election of Adolf Hitler. Berlin was a wide-open city of febrile rage and ferment. Starvation was common, and inflation ran at a rate difficult to comprehend. As has been mentioned, in August 1922, 400 German marks bought one United States dollar; in August 1923, the rate of exchange was 1 million marks to the dollar; and in November, it was 4.2 trillion marks to the dollar. Banks advertised for bookkeepers "good with zeros" and paid out cash withdrawals by weight (Rhodes, 1986, p. 18). Yet Berlin in the 1920s was also the city of the plays of Berthold Brecht, Marlene Dietrich in *The Blue Angel,* and the music of Kurt Weill. Yehudi Menuhin, at the age of 12, played Brahms, Beethoven, and Bach in concert with the Berlin Philarmonic; Albert Einstein listened in the audience. Berlin was the city of Ludwig Mies van der Rohe's first glass-walled skyscraper (Rhodes, 1986, p. 17). The University of Berlin was at the center of it all, and it was there that *Gestalt* psychology developed and peaked.

In 1922, the ascendancy of the *Gestalt* approach was confirmed when Wolfgang Köhler succeeded Carl Stumpf as director of the Berlin Psychological Institute. Sadly, the institute had little more than a decade of excellence under Köhler's leadership before the Nazis wrecked it. One of the first effects of the Nazis' seizure of the German government was the dismissal of Jewish professors from universities and research institutes. In 1933, 12.5 percent of the faculty at German universities were Jewish (Kampe, 1998). On April 7, 1933, Jews were expelled from the civil service, which included all professorial positions in German universities. By the end of that terrible year, 196 faculty, including at least 27 psychologists, had lost their academic positions. In the United States, an Emergency Committee in Aid of Displaced Scholars and Scientists (1933–1945) was organized and chaired by psychologist Livingston Farrand, the president of Cornell. That committee assisted academic victims of Nazi persecution in finding positions at American universities and colleges (Freeman, 1977). Assisted physicists included Enrico Fermi, who, while fleeing Mussolini's Italy, stopped in Stockholm on his way to New York City to accept his Nobel Prize; Leo Szilard, often called "the father of the atomic bomb"; Edward Teller, the director of the Los Alamos Laboratory, where the first atomic bomb was made; John van Neumann, who designed and built two of the world's first computers; and Albert Einstein (Rhodes, 1986). Fifty-one refugee scholars from Germany and Austria found academic refuge at nineteen historically black colleges predominantly in the South. At those colleges, the refugees were welcomed and widely respected. But they also saw the racial prejudice and discrimination their students faced. They had gone *From Swastika to Jim Crow* (Edgcomb, 1993).

Wertheimer was removed from his university position on April 26, 1933, and expelled from Germany. An unsuccessful attempt was made to find a position for him at the London School of Economics (Farr, 1996). Wertheimer emigrated to the United States, joining what came to be known as the University in Exile at the New School for Social Research in New York City. That enlightened institution rescued over 170 scholars, scientists, and their families from fascist Europe, including historian Hannah Arendt and anthropologist Claude Lévi-Strauss. Koffka had also emigrated to the United States, joining the faculty of Smith College in 1927. Köhler was soon forced to join his colleagues.

During the raids on German universities and the dismissals of Jewish professors, the majority of German academics and scientists kept silent. Their cowardice, Köhler believed, corroborated the Nazis' contempt for the intellectual life (Henle, 1978, p. 940). Many of them, including some psychologists, supported the Nazis (Wyatt & Teuber, 1944). Martin Heidegger was the most advanced and celebrated philosopher in Germany in the 1930s. He was a member of the Nazi party, actively supported Hitler, and dutifully enforced anti-Jewish regulations (Farras, 1988). Under the leadership of an avowed Nazi, Felix Kreuger, Wundt's Institute of Psychology at the University of Leipzig (Chapter 5) became "a folk-cell, that is, a germinating center for ultranationalistic activities" (Wyatt & Teuber, 1944, p. 232). In contrast, Köhler vigorously opposed the Nazis (Henle, 1978a). Clarke Crannell, an American student at the Berlin Psychological Institute, described the atmosphere in 1933:

> The Reichstag had burned. Everywhere in Berlin the Star of David was being chalked on the windows of shops and the shingles of physicians whose misfortune was to be Jewish. A stroll down *Unter der Linden* was not to be enjoyed without encountering a parade of brownshirts, their boots a staccato beat to their chilling war song. (Crannell, 1970, p. 267)

On April 28, 1933, Köhler wrote an article critical of the regime for the Berlin newspaper *Deutsche Allgemeine Zeitung,* the German equivalent of the *New York Times.* This was the last anti-Nazi article to be published under the Nazis. Expecting arrest, Köhler and his colleagues spent the night after the article's publication playing chamber music at the Insitute. The stormtroopers did not come, and Köhler was not arrested, probably due to his prestige and reputation. But abuses soon followed. In November 1933, a decree was handed down that professors must open their lectures with the Nazi salute. Shortly thereafter, Köhler gave a lecture to an audience of more than 200 people, including not only his students and colleagues but numerous brownshirts and Nazi sympathizers. He began by flipping his hand in a caricature of the Nazi salute and went on to outline his opposition to national socialism. The audience responded with thunderous applause, but the authorities were outraged (Crannell, 1970).

In December 1933, Harvard invited Köhler to deliver the next year's Third William James Memorial Lecture, to present a course of ten to twelve public lectures, and to conduct a graduate seminar. He accepted, but before leaving he faced provocation and harassment. Armed troops repeatedly "inspected" the Institute. In April 1934, Köhler resigned as the director, but his resignation was not accepted. He left for Harvard in September 1934. His lecture on epistemology and metaphysics was appealing to Harvard's philosophers, who urged his appointment to a faculty position. But Boring was particularly disappointed that Köhler had neglected experimental psychology, and as the Head of the Department of Psychology he opposed the appointment. One of Boring's arguments was that Harvard had made two grave mistakes, in his opinion, by previously appointing Münsterberg and William McDougall (Chapter 5). Boring felt the university could not risk the appointment of another foreign psychologist. Karl Lashley was appointed to the position, and Köhler returned to an uncertain future in Germany.

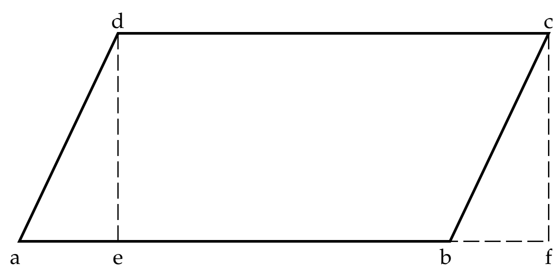
When Köhler was instructed to take an oath of loyalty to Hitler, he refused, and he continued to protest Nazi interference with the affairs of his Institute and to demand reinstatement of his Jewish colleagues and assistants. In August of 1935 his resignation was finally accepted. Köhler emigrated to the United States and accepted a position as a professor of psychology at Swarthmore College. Thus, by 1940, all three of the founders of *Gestalt* psychology, as well as Lewin, were in the United States. Unfortunately, three of them had short

American careers: Koffka died in 1941, Wertheimer in 1943, and Lewin in 1947. Only Köhler had a long American career until his death in 1967.

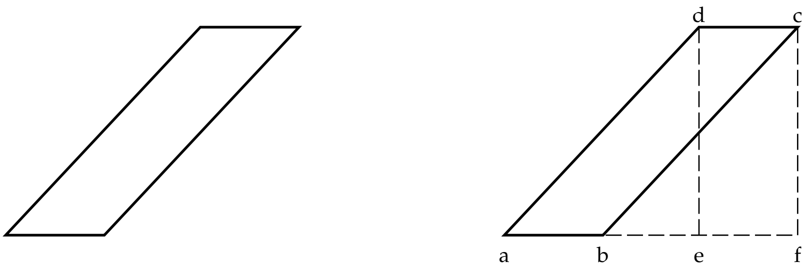
Wertheimer and the University in Exile

Wertheimer was a member of a small group of émigré European scholars who found academic freedom and refuge from totalitarianism at the University in Exile at the New School for Social Research in New York City. Alvin Johnson, the president of the New School, mobilized an effort to create a University in Exile for victims of Nazi persecution. The first group of refugee scholars, including Wertheimer, arrived in 1933 and began the school's first semester in October of that year. The New School had been founded to create America's first university for adults. It was an institution that viewed education as the most effective way to transform society and protect democracy. Its mission, "To follow the truth wherever it leads, regardless of personal consequences" was immensely appealing to Wertheimer and his colleagues. During the seven years he spent at the New School before he died, Wertheimer studied human thought and education. He had long been interested in these topics and had often given lectures and seminars on creative thinking and education. In 1932, one of his students, Erika Fromm, asked 100 scientists and philosophers, including Albert Einstein, Max Planck, Martin Heidegger, Kurt Koffka, Kurt Lewin, and Sigmund Freud, to describe their thinking as they developed their theories and research ideas. Forty-one replied to her inquiry, including Einstein and Freud. In his handwritten letter, Einstein said he was unable to describe his thinking in constructing his special theory of relativity. These fascinating letters were thought to have been lost until they were found by accident in 1997, translated into English, and published (Fromm, 1998). Wertheimer's book *Productive Thinking*, published posthumously in 1945 and reissued in 1959 in an edition edited by his son, psychologist Michael Wertheimer, documents a small part of the material he presented in his lectures and seminars (Luchins & Luchins, 1970). The book is original and provocative but difficult to read; some have said that Wertheimer was a better lecturer and seminar leader than writer (Köhler, 1944).

Wertheimer adamantly opposed rote methods of instruction and problem-solving techniques that emphasized the mechanical application of principles or formulas. Instead, he recommended a *Gestalt* approach that considers the problem as a whole. To demonstrate this approach, he gave an example of teaching children to find the area of a parallelogram. One schoolteacher Wertheimer observed taught his children the conventional method.



First the corners of the parallelogram were labeled *a, b, c,* and *d.* Then perpendiculars were dropped to two new points: from *d* to *e* and from *c* to *f.* Next, the base line was extended from *b* to *f.* Finally, the area of the parallelogram was found by multiplying the base by the altitude. With this method, pupils were able to find the area of various parallelograms, and the teacher was well-pleased with their progress. Wertheimer, however, suspected that the children had learned to apply the method mechanically, without a true understanding of the structure of parallelograms. With the teacher's permission, Wertheimer asked the students to find the area of the following figure:



Some of the children realized that if they turned the figure 45 degrees, they could use the method they had already learned. Many others were not as flexible and became confused, protesting that the problem was unfair, for they had never seen a figure like that. They tried to apply the method they had learned but were uncertain about what constituted the base of the figure. The teacher said to Wertheimer with some indignation: "You certainly gave them a queer figure. Naturally they are unable to deal with it" (Wertheimer, 1945, p. 17). Wertheimer, however, believed that the children's failure showed the inadequacy of the teaching method. He suggested teaching children to see the relationship between the parts of the parallelogram, to see it as a *Gestalt,* and to think productively. He demonstrated that any parallelogram can be broken into a number of parts.

When the parts of the parallelogram are reassembled, they form a rectangle whose area is easily computed. Once the children understood this, not only could they compute the area of any parallelogram, regardless of its dimension and altitude, they could compute the area of even more irregular figures simply by realizing that they could break such complex figures down into simpler ones.

As an example of spontaneous productive thinking, Wertheimer recounted an episode in the life of the eminent mathematician Carl Friedrich Gauss (Wertheimer, 1945, p. 90). Gauss's mother was illiterate and his father uneducated, yet Gauss became a prince of mathematics. When Gauss was six, his grammar school teacher asked the class: "Which of you will be the first to get the sum of 1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9 + 10?" While his classmates were still thinking about this problem, Gauss came up with the solution: 55. "How the devil did you get it so quickly?" the surprised teacher asked, not realizing he was dealing with a mathematical genius. Wertheimer reconstructed Gauss's thinking and decided that Gauss must have realized that the extreme numbers in the teacher's series always summed to 11:

$1 + 10 = 11$

$2 + 9 = 11$

$3 + 8 = 11$

$4 + 7 = 11$

$5 + 6 = 11$

There are five such sets of numbers, so their sum or whole must be $5 \times 11 = 55$.

Wertheimer believed that it would be possible to develop such insightful, productive thinking in all children, not just in geniuses like Gauss.[5]

Wertheimer also analyzed the thought processes Galileo Galilei might have used when he formulated the law of inertia governing falling bodies (Chapter 2) and the thought processes of Albert Einstein. The latter analysis grew from his friendship with Einstein, who, according to one report (Roback, 1952, p. 304), considered Wertheimer a genius. They spent many hours in Einstein's study reviewing how he came to formulate the general theory of relativity (Wertheimer, 1945, chapter VII). Wertheimer's discussion is too complex to summarize, but it is a unique analysis of the highest type of creative and productive thinking. Contemporary psychologists have also shown great interest in the definition and measurement of creativity (Guilford, 1954; Flanagan, 1963; Barron, 1969). Like Wertheimer, they often emphasize flexibility and novelty in productive thinking—think of eight uses for a rubber ball, a toothpick, a paper clip, a brick, or a one-foot ruler—rather than conventional rules and methods. Creative thinking has been of great interest to contemporary scholars (Finke, Ward, & Smith, 1992; Weber, 1993).

Wertheimer challenged traditional methods of teaching children problem-solving skills. Though his work was innovative, it did not have the impact it

[5] Even more impressive is this account of the 10-year-old Gauss's genius: "When Gauss was 10, the village schoolmaster thought to keep his large class occupied by writing down the integers from one to 100 and then finding their sum. Moments later, he was startled to see little Carl at his desk with just a single number on his slate. "There 'tis," said the boy and then sat down with his hands folded while the rest of the class toiled on. In the end, only Carl had the correct answer. The boy had at once perceived that the problem reduced to $(1 + 100) + (2 + 99) + \ldots (50 + 51) = 50(101) = 5050$" (Lykken, McGue, Tellegen, & Bouchard, 1992, p. 1573).

The brilliance and creativity of a contemporary mathematician, Paul Erdos, are described in Paul Hoffman's *The Man Who Loved Only Numbers: The Story of Paul Erdos and the Search for Mathematical Truth.*

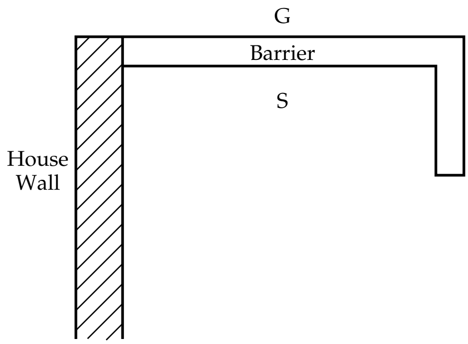
merited, on either the psychology of learning or on education. The major impact of *Gestalt* psychology resulted from research on animal learning done by Wertheimer's younger colleague, Wolfgang Köhler. That research provided both different observations of animal learning and a different theoretical explanation of the process itself. Since animal learning was a central concern of American psychologists, Köhler made a major impression.

THE INSIGHT LEARNING EXPERIMENTS OF WOLFGANG KÖHLER (1887–1967)

Wolfgang Köhler obtained a Ph.D. with Stumpf (Chapter 6) in Berlin in 1909, and, as we have seen, served as a subject in Wertheimer's Frankfurt experiments. In 1913, Stumpf arranged for Köhler's appointment as director of the Anthropoid Research Station on Tenerife in the Canary Islands. The Prussian Academy of Science sent him there to study the problem-solving abilities and general intelligence of a group of chimpanzees recently captured in Western Africa (Köhler, 1967, in Benjamin 1988, p. 521). He planned to stay just a few months but, because of the outbreak of World War I in 1914, Köhler found himself marooned on the island until 1920. He put his time to good use, doing his famous experiments on insight learning.

At the time, the prevailing view of animal learning was that of the American psychologist Edward Lee Thorndike (Chapter 10). After studying learning in chickens, monkeys, dogs, and especially cats, Thorndike had concluded that learning is a *trial-and-error* process dependent on the selective action of reward and punishment. Köhler, however, was dissatisfied both with Thorndike's conclusion and with the experimental situations he had used. In particular, Köhler questioned Thorndike's general conclusion that his animals did not reason, but rather learned mechanically through the selective action of reward and punishment. Köhler argued that Thorndike's animals might have been capable of reasoning but were unable to demonstrate it in the contexts of the problem situations Thorndike had used. Perhaps Thorndike's problem boxes forced animals to learn through trial-and-error, since more intelligent forms of problem solving were precluded. Köhler argued that in any test for higher levels of reasoning in animals, all the elements necessary for an intelligent solution must be present. Thus, debate was joined between Thorndike's connectionist, stimulus-response, trial-and-error view of animal learning and Köhler's approach—*Gestalt*, or what he termed *insight learning.* To prove the validity of his view, Köhler devised problem-solving tasks that allowed an animal to perceive the elements of the solution and arrive at the solution through *insight* rather than *trial-and-error.*

Köhler's first experiments were done with a dog, a chicken, and a young child. He believed that one characteristic of intelligent problem solving is the ability to switch to an indirect solution when a direct solution is blocked. Köhler developed the *Umwege* or detour problem, in which direct access to a goal is blocked and the subject is forced to make a detour.



In Köhler's first detour experiment, a dog was placed at position *S*, and food was placed at *G*. The dog ran smoothly and quickly around the detour to the food. Next, a 1-year-old child was placed at *S* and saw her doll placed at *G*. First she tried to push through the barrier, but then, Köhler reported, she "suddenly laughed joyfully, and in one movement was off at a trot around the corner to the objective" (Köhler, 1925, p. 14). Hens given detour problems behaved quite differently. They rushed about in front of the barrier in a confused and unintelligent manner and never made the required detour. Therefore, Köhler concluded, dogs and children are capable of the reasoning demanded by this situation, whereas hens are not.

The situations Köhler used in his experiments with chimpanzees were more complicated, for he found them to be interesting and intelligent animals. First he suspended a bunch of bananas in a basket from the wire roof of the animals' enclosure. The chimpanzees could not reach the bananas by jumping, the obvious direct solution, so they were forced to develop an indirect way of reaching the food. A scaffold on one side of the enclosure was well within the arc of the swinging basket. When the animals first entered the enclosure, they made futile attempts to jump up to the basket, but then one of them, Chica, "quietly surveys the situation, suddenly turns towards the scaffolding, waits with outstretched arms for the basket, and catches it. The experiment lasted about a minute" (Köhler, 1925, p. 19). Next the scaffolding was removed, making the problem more difficult, but another chimpanzee, Sultan, rose to the challenge. He climbed onto a roof beam within reach of the bananas as they swung past.

Köhler also gave his animals problems in which they had to use sticks as implements or tools. First he placed bananas outside the enclosure, out of the chimpanzees' reach. A number of sticks lay in the cage. One of the animals, Tschego, first tried unsuccessfully to reach the bananas with her hands, but after half an hour she gave up. She lay down quietly in the cage until a group of younger animals outside approached the fruit. Then, "suddenly Tschego leaps to her feet, seizes a stick, and quite adroitly pulls the bananas till they are within reach" (Köhler, 1925, p. 32). Apparently all Tschego needed was a little social motivation. In another version of this test, the animal had to use a short stick to rake in a longer one and then use the longer one to rake in the bananas. Again, the animals were successful. In a still more complicated test, a banana lay outside the cage at such a distance that it could not be reached by either of two sticks left in the cage. However, if the two sticks were fitted together, their combined length was sufficient to reach the fruit. At one point, Köhler demonstrated the solution by putting one of his fingers into the end of one of the sticks, but that did not aid Sultan. Köhler then left Sultan in the charge of a keeper, who later reported:

> Sultan first of all squats indifferently on the box, which has been left standing a little back from the railings; then he gets up, picks up the two sticks, sits down again on the box and plays carelessly with them. While doing this it happens that he finds himself holding one rod in either hand in such a way that they lie in a straight line; he pushes the thinner one a little way into the opening of the thicker, jumps up and is already on the run towards the railings, to which he had up to now half turned his back, and begins to draw a banana towards him with a double stick. (Köhler, 1925, p. 127)

This whole sequence took less than five minutes.

Next a banana was suspended from the roof, out of reach. First Sultan tried to knock it down with a stick. Then he dragged a box under the banana, climbed on it, and successfully knocked the fruit down. Subsequently, Sultan and a number of other chimpanzees built towers of as many as four boxes. On one occasion when fruit was suspended from the roof, no boxes were in the cage, so Sultan pulled a keeper under the fruit and climbed on his shoulders to reach it. The chimpanzees were also seen climbing on each other's shoulders or scaling a sturdy pole placed under the fruit until it fell down. One of Köhler's photographs shows Chica, at least four or five feet high on an almost vertical pole, grasping a suspended banana with one hand and holding the very end of the pole with the other.

In addition to allowing the animals to survey the whole problem, Köhler's experiments had several characteristics. First, they were done in the animals' home enclosure or cages. Köhler believed that in such situations the animals were the most comfortable and so would be the most likely to show intelligent behavior. Second, as we have seen, he often tested his animals in the presence of others. Köhler believed such a situation was the most natural; he considered the behavior of animals tested alone to be abnormal. Incidentally, this group testing also allowed Köhler to observe such social phenomena as learning by observation and imitation. Third, Köhler reported his results descriptively, with very few numbers and statistical interpretations. He believed that the most valuable aspects of his observations would be lost if they were handled in an abstract, statistical fashion.

Practically all of Köhler's remarkable observations were made during the first six months of 1914. Köhler spent his remaining years on Tenerife replicating and extending these results. In doing so, he caused some consternation among British intelligence agents who could not believe a scientist would spend so much time finding out how a chimpanzee learns to get bananas. They were convinced that his reports of the experiments were part of an ingenious

German espionage plan (Gleitman, 1981, p. 138). Ronald Ley (1991) alleged that Köhler was involved in a "whisper of espionage," an allegation that has been challenged (Harris, 1991). Köhler's goal was scientific, not political.

Köhler first reported his results in a monograph of the Berlin Academy of Science in 1917 and then in a book published in Germany in 1921. However, their greatest impact followed the publication in English in 1925 of his book *The Mentality of Apes.* Köhler called the cognitive activity he had observed *insight learning* and said:

> We can, in our own experience, distinguish sharply between the kind of behavior which from the very beginning arises out of a consideration of the structure of the situation, and one that does not. Only in the former case do we speak of insight, and only that behavior of animals definitely appears to us intelligent which takes account from the beginning of the lay of the land, and proceeds to deal with it in a single, continuous and definite course. Hence follows this criterion of insight: the appearance of a complete solution with reference to the whole lay-out of the field. (Köhler, 1925, p. 190)

Köhler described the properties of *insight learning.* First, such solutions are based on a perceptual restructuring of the problem. The animal "sees" or "perceives" the solution. It is characterized by a sense of "Ah, I have it" or "Aha" learning like that of Archimedes when he took his famous bath. In contrast, Thorndike's *trial-and-error learning* is slow and gradual. Second, *insight learning* does not depend on rewards. The fruits Köhler used provided incentives but were not responsible for the learning; the animals solved the problems before they ever ate the fruit. Third, *insight* solutions are characterized by generalization, or large amounts of positive transfer, from one problem to another. Köhler's animals became test-wise, or sophisticated; once they had solved one implement or stacking problem, they could quickly solve similar problems.

The qualities of *insight learning* become evident when humans are given *insight* problems. Consider two bicyclists 20 miles apart, who head towards each other riding at a constant speed of 10 m.p.h. At the same time, a small but energetic bird flies at a constant 15 m.p.h. from the first bike until it reaches the front wheel of the other one. Then it instantly turns around and flies back until it meets the wheel of the first bike. The bird continues in this pattern until the two riders meet. The question is, How far does the bird fly before it is crushed between the two front wheels? One could find a brute-force, noninsight solution by calculating the distance the bird flies on each leg and summing those distances. One could arrive at an insight solution by seeing that the riders will meet exactly one hour after they start, when each has traveled 10 miles, and in that time the bird flying at 15 m.p.h. will have covered 15 miles. It is surprising that even gifted mathematicians miss the *insight* solution. For example, when this problem was put to John von Neumann, one of the great mathematical geniuses of the twentieth century (Macrae, 1992), he did his characteristic dance while concentrating and answered immediately "15 miles." "Oh, you've heard the trick before," said the disappointed questioner. "What trick? asked the puzzled Johnny (von Neumann). "I simply summed the infinite series" (Macrae, 1992, pp. 10–11).

In 1925, Köhler visited the United States as a visiting professor at Clark University. He enjoyed the vastness and beauty of America and the friendliness of its inhabitants. Even the dogs, he is reported to have said, were friendly (Henle, 1986, p. 238). He gave numerous successful lectures on problem solving and insight learning in chimpanzees, but did not lecture in the South. As Mary Henle explains:

> After all, 1925 was the year of the Scopes trial in Tennessee, the famous "monkey trial," in which a young high-school teacher was convicted of teaching evolution. Köhler subsequently learned that one of the best Southern universities would not invite him to speak on his work with the chimpanzees because it would "arouse a storm of indignation all over the state." (Henle, 1986, pp. 238–239)

Köhler's *Mentality of Apes* is a remarkable book which shows clearly the power of *Gestalt* principles in guiding and organizing a research program. In addition to descriptions of insight learning, the book contains many interesting observations on discrimination learning, memory, and emotion in animals. According to stimulus-response theorists such as Thorndike, an animal learns in a discrimination experiment to respond to a particular stimulus with a specific response; according to *Gestalt* theory, the animal learns to respond to the stimulus situation as a *Gestalt* or whole, especially in regard to relationships between stimuli. Köhler's elegant test of these different conceptions involved the *transposition* of stimuli. First, a chicken was trained to discriminate between two shades of gray. Pecking at a dark gray card (II) always produced a reward of food; pecking at a light gray card (I) never produced food.

Chickens are not the most intelligent animals, but after between 400 and 600 trials they would peck consistently at card II and rarely at card I. What exactly had the chicken learned? Had it learned to peck at the gray stimulus card, the stimulus-response (S-R) view, or had it learned to inspect the relationship between the two cards and respond to the darker one? Köhler's test was ingenious. He transposed the stimuli so that the chicken had to choose between the original dark gray card (II) and a black card (III):

S-R theory predicts that since the original stimulus is present, the chicken should respond to card II; *Gestalt* theory predicts that the chicken should select the darker of the two stimuli in this new situation and so peck at card III. The majority of Köhler's chickens chose card III on the *transposition* test. Similar experiments with apes and children using more complex stimulus dimensions such as color and form yielded similar results. On transposition tests, the subjects invariably chose the new stimulus, suggesting that they were responding to the relationship between stimuli and to the field as a whole rather than to an isolated and specific stimulus. One test of the adequacy of a theory is its ability to suggest critical tests. The transposition experiment is an impressive demonstration of the capacity of *Gestalt* theory to provide such a test and is also, of course, an impressive demonstration of Köhler's ingenuity as an experimenter.

A second major observation Köhler made concerns animal memory. He was convinced that an ape's memory is limited. In one experiment, he covered a very large square of ground with several inches of sand. He made some marks and lines in the sand and a small hill to serve as landmarks. Then, while a restrained ape watched, Köhler buried food in the sand. When released after a short delay, the ape went immediately to the right spot and dug up the food; when released after several minutes, the ape searched all over the ground before finding the food. This finding suggested to Köhler that an ape's memory is limited to recent events.

Finally, Köhler rejected empiricist accounts of emotion, which claimed that emotional reactions are acquired through experience (Chapters 2 and 12). How could such accounts explain the paroxysms of terror his animals showed when they first saw a strange animal, such as a camel, walk past their enclosure? In one instance, the fear reaction was so intense that Köhler could not conduct experiements for several days. Intense fear reactions were also elicited by mechanical toys, stuffed animals, a snake, and a mask. Köhler reported:

> One day, as I approached the stockade, I suddenly pulled over my head and face a cardboard copy of the mask of a Cingalese plague demon (certainly an appalling object), and instantly every chimpanzee, except Grande, had disappeared. They rushed as if possessed into one of the cages, and as I came still nearer, the courageous Grande also disappeared. (Köhler, 1925, pp. 322–323)

Köhler argued that such an immediate and intense reaction could not have been learned, because the mask had never been paired with punishment.[6]

The research findings he reported in *Mentality of Apes* convinced Köhler that *trial-and-error learning* cannot account for the complex problem-solving behaviors of animals and humans. Today, differences between *insight* and *trial-and-error learning* do not appear as clear-cut as they were to Köhler. Even in his own experiments, Köhler clearly saw that solutions were often preceded by behaviors that resembled *trial-and-error learning.* Also, animals in trial-and-error sometimes show sudden, insightlike learning. The different experiments and interpretations of Köhler and Thorndike were a reflection of their conceptions of basic psychological processes: for Köhler, *Gestalt;* for Thorndike, *functionalism.*

[6] The Canadian psychologist Donald Hebb, working with chimpanzees in the United States, replicated Köhler's findings and made an additional discovery. When shown models of human and animal heads detached from the body, infants showed no fear, half-grown chimpanzees showed increased excitement, and most of the adults were terrified (Hebb, 1949, p. 243).

Historically, *Gestalt* psychology has been associated with the work of Wertheimer, Koffka, and Köhler. Indeed, these three men laid the theoretical, conceptual, and empirical foundations for this new approach to psychology. One of their colleagues with a more applied bent, Kurt Lewin, was able to use the concepts and approaches of *Gestalt* psychology to address broader psychological questions of personality development, worker efficiency, and various social behaviors and problems.

KURT LEWIN (1890–1947) AND THE APPLICATION OF GESTALT PSYCHOLOGY

Kurt Lewin's influence on contemporary psychology has come to be acknowledged by many (Stivers & Wheelan, 1986; Patnoe, 1988; Kendler, 1989). But even psychologists who recognize the importance of his creative and innovative work are faced with a dilemma: nobody seems sure how to pronounce his name. Should it be *Loo-in* or *La-veen*? When he first arrived in the United States, Lewin used the German pronunciation, *La-veen.* Later he changed to the American pronunciation when his children were embarrassed by having to explain the German pronunciation to their American friends (Marrow, 1969). To the pedant's dismay, both pronunciations are correct.

Lewin's Early Life

Lewin was born September 9, 1890, in the village of Moglino in the Prussian province of Posen, now part of Poland. His family had a small farm, but they lived above the general store they owned. He was the second child and first son in a family of four children and was raised in a warm and affectionate middle-class Jewish home, but that did not protect Lewin from the discrimination and anti-Semitism of life in Germany at the turn of the century. Lewin's educational, social, and eventually occupational opportunities were restricted. In 1905, Lewin's family moved to Berlin, and he finished his high school education at the *Kaiserin Augusta Gymnasium.* Until that time, his schoolwork had not been good and he had been best known for his fierce temper. Only during his last two years at the *Gymnasium* did his high intelligence become apparent.

After studying medicine and biology at the universities of Freiburg and Munich, Lewin transferred to the University of Berlin in 1910. Stumpf's Psychological Institute and the Berlin Department of Psychology (Chapter 6) were lively environments, and Lewin was intrigued by the possibility of a science of psychology. However, he found many of the department's courses in the "grand tradition" of Wundtian psychology irrelevant and dull. All too often, it seemed that psychologists performed small, disconnected studies that never formed a meaningful whole. Lewin spent three years at Berlin using nonsense syllables in a reaction-time experiment before concluding that his research was pointless. He sought a new, more relevant psychology.

Lewin was one of a lively group of students concerned about the limited educational opportunities available to Berlin's working classes, the type of problem Lewin felt psychologists could help solve. With this in mind, he organized a series of workers' courses to teach basic skills. The university authorities opposed such courses, considering them subversive, but this early "university without walls" was successful. All his life, Lewin retained his commitment to applying psychology to the problems of society. When World War I broke out in 1914, Lewin had completed all the requirements for a Ph.D. and was about to graduate. He volunteered for the army and served four years in the killing trenches, winning an Iron Cross before being wounded and hospitalized in 1918. His degree had been conferred in 1916 with Stumpf as his adviser, though Lewin later recalled that Stumpf did not once discuss his doctoral research with him (Lewin, 1937). Still, Lewin regarded Stumpf as one of the two most important German psychologists of the time, Georg Elias Müller (Chapter 6) being the other.

Lewin's Early Writings

While on furlough in 1917, Lewin published a remarkable paper, *The War Landscape,* describing the soldier's experience of war. He referred to the soldier's *life space* and also used such terms as *boundary, direction* and *zone,* all of which were to become central to his *topological theory.* Lewin stressed that a soldier's *life space* is very different from that of a civilian. To a civilian, a shady path below some cliffs is an ideal spot for a stroll or picnic; to a soldier, it is a dangerous place of possible ambush. Within the context of peace, actions such as burning furniture or books as fuel would be considered barbaric, but in times of war, they are understandable. Lewin also described the *depersonalization* and *dehumanization* of "the enemy" as the embodiment of all evil.

After his demobilization in 1918, Lewin returned to the Berlin Psychological Institute as a colleague of Wertheimer and Köhler and a professional friend of Koffka. Lewin found the *Gestalt* approach of these men appealing, but his professional interests stressed application more than theirs did. In 1919, he published two papers on the laborer in agriculture and industry in which he returned to the theme of his army paper. Despite the apparent similarities between agricultural and industrial workers—for example, their days involve hard physical labor—Lewin argued that their *life spaces* differ substantially. The industrial worker must develop a specialized skill to be used every day, whereas the agricultural worker must use many different skills each day and in each season of the year. Lewin also felt that though an industrial worker often makes more money, agricultural work may be more satisfying. In his paper, he also discussed the well-known time-and-motion studies of the pioneering American industrial engineer Frederick Winslow Taylor (1856–1915). Taylor had begun his studies of workers in machine shops in the 1880s. In 1911, he published *The Principles of Scientific Management.* Taylor advocated a stopwatch-and-clipboard approach to factory life that places the system above all else. Worker motions were to be timed and all unnecessary and inefficient motions eliminated in the drive toward increased industrial efficiency and productivity. Taylor was a strong advocate of *piece-rate* pay schedules in which workers receive pay based on the number of items they produce. Workers and their unions opposed such work schedules as exploitative since the employer controls the work requirement. Taylor supported piece-rate work with colorful

Tamara Dembo (1902–1993): A Gestalt Psychologist in Germany, the Netherlands, and the United States

Tamara Dembo did innovative and important research within the framework of *Gestalt* psychology in Germany, the Netherlands, and the United States. Her later research with Lewin in the United States is well-known, and she is considered one of the founders of the field of rehabilitation psychology. The recent discovery of her personal archives has shown the quality of her earlier work and has given us additional historical information on *Gestalt* psychology (Van Der Veer, 2000).

Dembo was born into a Russian-Jewish family in Baku in Transcaucasia. She arrived in Berlin in 1921 to study mathematics at the University of Berlin. After hearing Lewin lecture on psychology, Dembo emphasized psychology in her studies and joined a cosmopolitan and lively group of Lewin students at the Psychological Institute of the University of Berlin. Zeigarnik and two other Russian women were members of the group. From 1925 to 1928, Dembo worked with Köhler and Lewin on the research that formed the basis of her dissertation. Her aim was to study the origin and development of anger in a setting where it could be observed and assessed. Van Der Veer outlined Dembo's experimental approach:

> Dembo decided to provoke anger in the laboratory. This was done by confronting subjects with problems that were either impossible or very difficult to solve and at times by actively hampering their efforts at solution. During the problem-solving process, the subjects were being watched by the experimenter and her assistant. The assistant made shorthand reports of everything that was said, and the experimenter made note of the global events that took place. This resulted in protocols of about 15 pages per session. Afterward the subjects were questioned about their feelings during the experiment. (Van Der Veer, 2000, p. 112)

Dembo also used a ring-throwing task: the subject was required to throw ten rings in a row from 3.5 meters (11.5 feet) onto a bottle, a very difficult task. Observers ridiculed and disparaged misses to provoke the subject's anger. Dembo desribed reactions of anger and annoyance: cursing, attempts to leave the situation, displaced aggression—throwing a ring at the observer—along with the subjects' attempts to control themselves and hide their feelings. Her *Gestalt* analysis of their behavior used Lewin's concept that a *field of forces* or *vectors* influence subjects. Her dissertation was accepted in 1930.

While writing her dissertation, Dembo worked at the Physiological Institute of the University of Groningen in the Netherlands with F. J. J. Buytendijk (1887–1947), a physiologist interested in a *Gestalt* approach to the study of ani-

anecdotal accounts of workers seemingly transformed by piecework incentives. He also used unfortunate ethnic stereotypes, as when he labeled a model immigrant worker, Schmidt, "a man of the mental sluggish type" (Banta, 1993). A common reaction to Taylor's approach among workers is revealed by his nickname, "Speedy," but his time-and-motion studies were in vogue among managers. Taylor has been described as "the Ross Perot or Lee Iacocca of his day" (Heller, 1993, p. A8), and Peter F. Drucker (1993) compared him with Freud and Darwin as one of the three makers of the modern world. Lewin was more critical. In a paper published in 1920, "The Socialization of the Taylor System," Lewin argued that work is more than producing at maximum efficiency.

Tamara Dembo (1902–1993): A Gestalt Psychologist in Germany, the Netherlands, and the United States (Continued)

mal behavior. At Groningen, Dembo observed the free behavior of rats in a "spacious maze" in which two glass plates partially blocked the path to food but allowed the rat to see the food from the start area. The rats learned to zigzag round the plates. Her most interesting observations followed the removal of the first of the plates. Two of her rats initially followed the original zigazg course before taking a direct route.[7] The rats' behavior was thus not a chain of responses but a reaction to the situation as a whole. Dembo also observed rats in what she called an "amusement park," a large box filled with a variety of objects and devices assumed to be of interest to a rat. Finally, Dembo observed learning and problem solving in birds and fish.

In 1930, Dembo emigrated to the United States, joining Koffka at Smith College and then, in 1934, Lewin at the University of Iowa. She collaborated with Lewin on a series of *Gestalt* studies of young children, the best known of which was an investigation of the effects of frustration. Dembo left Iowa in 1943 for Stanford University where until 1948 she directed pioneering research projects on the psychological rehabilitation of people who had been blinded or lost limbs. In their adjustment to misfortune, Dembo found that many people felt *devalued* and *depersonalized.* After brief stays at the New School for Social Research in New York City and at Harvard, Dembo joined the faculty at Clark University from 1953 to 1980. At Clark, Dembo continued her work on rehabilitation psychology (Dembo, Levition, & Wright, 1975). True to her *Gestalt* approach, Dembo

> never took the environment for granted. When she began her pioneering work on rehabilitation psychology, most people saw a person without legs as a "handicapped" person. She, however, saw a person who could not get upstairs. She saw the stairs as handicapping the person and successfully argued for ramps and elevators. She taught us to see that disabilities are in the environment rather than in the person. (De Rivera, 1995, p. 386)

Dembo exemplifies the characteristics of the *Gestalt* approach to psychology: an emphasis on the whole field of forces acting upon a subject, small numbers of subjects carefully observed, and dynamic explanations of their behavior. Her remarkable international career showed the power of a *Gestalt* approach to psychology.

[7] Twenty years earlier, Watson (Chapter 12), working at the University of Chicago with a different theoretical orientation and using a runway and maze, made similar observations.

Work has *life value* and must be enriched and humanized. We do not live to produce, Lewin argued; we produce to live. He was to return to this area of research later in his life as he sought ways in which psychology might contribute to the workplace.

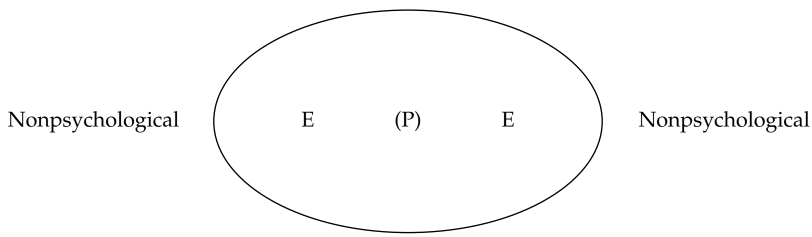
In 1921, Lewin was appointed a *Privatdozent* at the University of Berlin, and even among the galaxy of stars at the university, he was able to attract students to his lectures and research programs. That was fortunate, for as a *Privatdozent,* much of his income depended on the number of students taking his courses. All his life, Lewin enjoyed close relationships with his many students. Within the Berlin Psychological Institute they formed a close group and would often meet for informal discussions at the Swedish Café across the street. It was there that Lewin noticed that the waiters recalled their customers' bills until they were paid for and then forgot them, the observation that stimulated Zeigarnik's research mentioned earlier in this chapter. The ability to translate such everyday observations into important research was characteristic of Lewin all his life. However, his research always followed *Gestalt* principles and was conducted within the theoretical framework of *Gestalt* theory, for as he often said, "There is nothing as practical as a good theory" (Lewin, quoted by Marrow, 1969, p. viii). What were some of Lewin's theoretical conceptions?

Lewin's Topological Psychology

Lewin thought of an individual as a complex energy field, a dynamic system of needs and tensions that directs perceptions and actions. Behavior *(B)* is a function *(f)* of a person *(P)* interacting with an environment *(E).* In his formula

$$B = f(P,E)$$

each person moves in a psychological field Lewin termed the *life space.* A life space contains certain goals that have either positive or negative *valence.* These in turn create *vectors* that either attract or repel. To represent these concepts, Lewin borrowed from topology, a nonquantitative representational geometry. His aim was to develop a *topological psychology.* To show a person's separation from the rest of the world, Lewin diagramed the life space as enclosed in *Jordan curves,* or egg-shaped forms:



In this diagram, *P* and *E* form the individual's life space, and the curve separates the life space from the rest of the world. Lewin's papers are filled with diagrams like this. His students at Berlin knew them as *Lewin's eggs,* and a later generation of students at the University of Iowa called them *Lewin's potatoes* (Thompson, 1978). They symbolized his attempts to describe the dynamics of human behavior.

Lewin was a highly visual thinker, forever diagramming life situations with chalk on the nearest blackboard, with paper and pencil, or, if nothing else was at hand, with a stick in the dust or snow. In winter, Lewin would often walk up and down in front of his house discussing problems in depicting life spaces with his students. After such discussions the snow was often covered with topological diagrams. Heider recalled Lewin frenetically drawing topological diagrams with his umbrella in the snow while waiting for a train in Berlin (Harvey &

Burgess, 1990, p. 177). Once, at a convention, Lewin gave a particularly impressive lecture. One skeptic was not convinced and asked how he took into account the complexities of individual differences in his life space diagrams. Lewin replied, "That's easy—I just use different colors of chalk" (Thompson, 1978).

Lewin's theory and research first became widely known to English-speaking psychologists following the publication by J. F. Brown of "The Methods of Kurt Lewin in the Psychology of Action and Affection" in the 1929 *Psychological Review.* Brown, one of the first American students to study with Lewin in Berlin, outlined Lewin's concepts and described experiments by Zeigarnik and a number of other Lewin students. He emphasized Lewin's concern with total acts, or *Gestalts.* Brown warned psychologists not to dismiss Lewin because he had not discovered absolute psychological laws. Rather, Brown wrote, Lewin had been able

> to set up, measure, and predict psychic energies with as much accuracy as the physicist used in the early days of dynamic concepts in his science. Like all pioneers, rather than dictate finished laws, Lewin's aim has been to indicate directions and open new paths for experiment from which laws must eventually come. (Brown, 1929, p. 220)

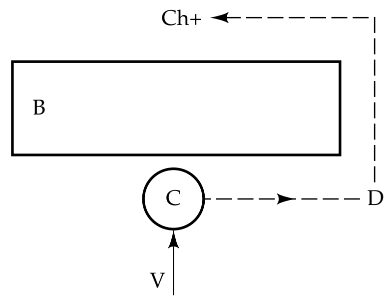
Also in 1929, Lewin presented a paper entitled "The Effects of Environmental Forces" at the Ninth International Congress of Psychology at Yale University. He described his basic concepts and presented a film illustrating their application. The film showed an eighteen-month-old infant's attempts to sit on a marked spot on a stone. Clearly, she was not sure she would be able to sit on the spot if she once looked away from it. As a result, she circled the stone many times trying to work out a way to sit on the spot without looking away from it. Finally, she put her head between her legs, backed over the stone, and was able to sit on the marked spot without ever taking her eyes off it—a wonderfully insightful solution.[8] Lewin lectured in German, which many in his audience did not understand, but the film could be seen by all, and he was such a visual lecturer with his diagrams and illustrations that he was able to overcome the language barrier. A Harvard psychologist, Donald MacKinnon, recalled his lecture. "He was a genius at being able to follow children around with his camera and get bits of behavior to illustrate the principles he was already developing. And he came across as a terribly exciting man—excited about what he was doing and about the presentation" (MacKinnon, cited by Marrow, 1969, p. 51). Harvard social psychologist Gordon Allport attended Lewin's lecture. He later wrote, "To some American psychologists, this ingenious film was decisive in forcing a revision of their own theories of the nature of intellectual behavior and of learning" (Allport, 1968, p. 368).

Carl Murchison invited Lewin to contribute a paper to the forthcoming *Handbook of Child Psychology.* Lewin's *Environmental Forces in Child Behavior and Development* translated by Donald Adams, appeared in the 1931 *Handbook* along with papers by Mary Cover Jones (Chapter 12), Arnold Gesell (Chapter 9),

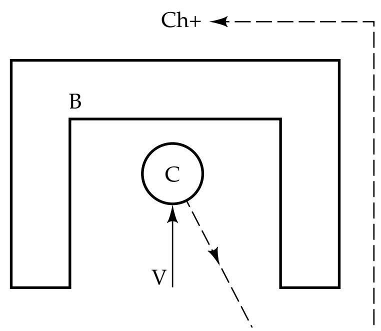
[8] In a major review of Lewin's ideas and methods Ash (1992) described the child in Lewin's film as a boy. That is incorrect, as the child was Lewin's wife's niece, an eighteen-month-old child named Hannah (Marrow, 1969, p. 49).

Lewis Terman (Chapter 11), and Anna Freud (Chapter 8). In the paper, Lewin criticized statistical approaches to child behavior and conceptions of the "average child." Such a child, he said, was a "statistical myth." Rather, Lewin focused on the behavior of the individual child. For him it was much more useful to know a single case in depth than to know many cases in only a few aspects. The totality, or *Gestalt,* of the child's life space must be studied, and since each life space is different, that requires intense and concentrated effort.

According to Lewin, the infant's life space is small and undifferentiated; an infant is able to perceive and affect only a small portion of the environment. As he or she develops, the life space grows larger and more differentiated. To illustrate this change, Lewin gave the example of a doll placed a few feet from an infant. The doll can be taken away and even broken without any protest from the infant; the same actions will elicit a violent reaction from a 3-year-old. Lewin also described a number of experiments in which children had to solve detour problems (Lewin, 1931, p. 104). In one such problem, chocolate is on the other side of a barrier. The child *(C)* has to make a detour *(D)* around the barrier *(B)* to reach the positive-valence chocolate *(Ch).*



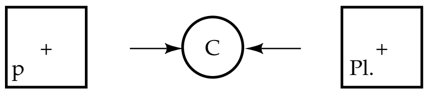
The problem is difficult because the child has to move counter to the positive vector *(V).* In another version of the problem, the child actually has to move in a direction opposite to that of the vector to obtain the chocolate (Lewin, 1931, p. 104):



These problems were similar to the *detours* Köhler had used, and Lewin's explanation of the children's behavior was similar to Köhler:

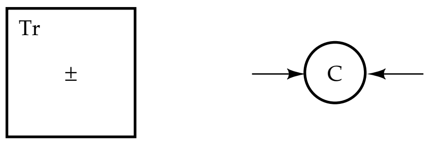
> When the child finds the solution of such a detour problem it happens by reason of a restructuring of the field. There occurs a perception of the total situation of such a kind that the path to the goal becomes a unitary whole. The initial part of the route, which "objectively" is still a movement away from the goal, thereby loses psychologically that character and becomes simply the first phase of a general movement toward the goal. (Lewin, 1931, p. 105)

Lewin also presented descriptions and diagrams of constellations of forces in conflict. He diagrammed the first type of conflict (Lewin, 1931, p. 109):



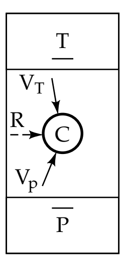
A child *(C)* must choose between playing with friends *(P1)* and going on a picnic *(P).* Since both activities have a positive valence, the choice is easily made, and the conflict is resolved. However, Lewin pointed out that once such a choice is made, the chosen activity often seems inferior. For instance, you must decide between two brands of a product. Once you make a choice and purchase one, the rejected brand often appears increasingly attractive.

Lewin diagrammed a second type of conflict (Lewin, 1931, p. 110):



A child wants to climb a tree *(Tr)* but is afraid; approach and avoidance vectors are simultaneously present. Often in such a situation the child will approach the tree, back away, and then approach again as the vectors wax and wane. A young child at the ocean for the first time is a good example of someone experiencing this type of conflict. The child runs to the water, but then backs away as a wave rolls in, approaches again, and then retreats as another wave appears.

Lewin diagrammed a third type of conflict (Lewin, 1931, p. 111):



Now the child stands between two negative valences. An example of this would be when a parent uses a threat of punishment *(P)* to force a child to do something *(T)* the child does not want to do. Now two avoidance vectors are simultaneously active. The most common outcome, according to Lewin, is the "sideways resultant" of the two vectors *(R),* which leads the child to try to escape from the field.

Lewin in the United States

Environmental Forces in Child Behavior and Development secured Lewin's reputation as a brilliant and creative thinker. His field analysis of conflict situations is still a feature of contemporary psychology texts. American psychologists were eager to learn more about his work, and in 1932 Lewis Terman (Chapter 11) invited Lewin to spend six months as a visiting professor at Stanford University. Lewin enjoyed his stay in California, and though he was the friendliest and most informal of academics—his former students' always refer to him as Kurt—he did enjoy being called "Professor" for the first time in his life.

Lewin returned home via the Pacific, visiting former students in Japan and Russia and giving lectures in both countries. On his way back to Germany on the Trans-Siberia Express, Lewin heard the terrible news that Hitler had become chancellor of Germany. He concluded that he could not live in Nazi Germany, even though as a decorated World War I veteran he was formally exempted from the Nazi law which mandated the removal of Jewish professors. In 1933, Lewin resigned from the University of Berlin, stating publicly that he had no wish to teach at a university that would not admit his children as students. As had been the case with Wertheimer, an attempt to find a position for Lewin at the London School of Economics was unsuccessful (Farr, 1996). Lewin sought help from his American colleages, and they responded. Robert Ogden, whose work with Külpe was mentioned in Chapter 6, was dean of the School of Education at Cornell University. He respected the work of the *Gestalt* psychologists and had invited Koffka to Cornell as a visiting professor and had arranged for Köhler to give two series of lectures at the university (Ryan, 1982). Lewin had also lectured at Cornell in 1932, and Ogden admired both his research and his personal qualities. Ogden brought Lewin's desperate situation to the attention of Cornell's president, Livingston Farrand, who was the chairman of the Emergency Committee in Aid of Displaced German Scholars and Scientists. At issue was Lewin's ethnic background. His American supporters, including Boring, argued that his "extremely personal qualities mitigate the 'defect' of his Jewishness" (Winston, 1998, p. 35). With the Emergency Committee's support, Ogden was able to offer Lewin a nonrenewable faculty appointment at Cornell for two years (1933 to 1935) at a yearly salary of $3,000. His appointment was not to the faculty of the Cornell Psychology Department, but was in the School of Home Economics. Lewin left Germany in August 1933, never to return. At Cornell he studied a topic of interest to his new colleagues in the School of Home Economics, the eating habits of children. However, he had a unique point of view and studied eating as influenced by the *Gestalt* of a child's social situation. Specifically, he investigated the effects of social pressure on children's choices of foods they either liked or disliked. When he arrived at Cornell, Lewin's English was not good and his language difficulties, frequent malapropisms, and misused colloquialisms created situations that his students—and Lewin, too—found hilarious. One of his favorite ways of disagreeing was to say, "Can be, but I think absolute ozzer!" That phrase, in a heavy, mock-German accent, became a favorite slogan of his American students (Thompson, 1978).

During Lewin's two years at Cornell, the United States was in the depths of the worst economic depression in its history. More than a quarter of the nation's workforce were unemployed. Soup kitchens, bread lines, and men selling apples on street corners were new features of urban life. Yet his two years at Cornell were productive ones for Lewin. He published two major works, *A Dynamic Theory of Personality,* with Fritz and Grace Heider, and *Principles of Topological Psychology,* with Donald Adams and Karl Zener. Both books, especially the latter, were difficult works that did not receive the recognition they deserved. Lewin's *topological analysis* was still unfamiliar to most psychologists, and some of the reviews of these works were negative. In 1935, his appointment at Cornell ended, and as there was no chance of reappointment, Lewin was forced to seek another position. He had been organizing a psychological institute he hoped to found at the Hebrew University of Jerusalem and persuaded Boring, Terman, Thorndike, and McDougall to serve on the 1935 Committee of Sponsors (Marrow, 1969, p. 83). His aim was to conduct psychological research on the problem of Jews emigrating to Palestine from Europe and, more generally, on the roots of anti-Semitism and ways to combat it. Lewin was unable to secure adequate financial backing, and this visionary project failed, but he still considered leaving the United States for Palestine. Lewin's appointment to an academic position at Hebrew University was strongly opposed by Freud, who believed "he was not the right man to accomplish a synthesis between psychoanalysis and [academic] psychology" (Lück & Rechtien, 1989, p. 141). Fortunately for American psychology, Lewin found a position at the Child Welfare Research Station at the University of Iowa. As this, too, was not a regular faculty appointment for the first three years, Lewin was supported by a grant from the Rockefeller Foundation. At this stage in his career, Lewin was still something of an outsider—and in fact he remained so all his life. It is a surprise to find, for example, that he was never elected president of the American Psychological Association.

Lewin at the University of Iowa

Lewin's first years at Iowa City were happy and productive (Ash, 1992). The Rockefeller grant also provided fellowships for Dembo and a number of postdoctoral fellows. As he had done at both Berlin and Cornell, Lewin quickly attracted students, and they, too, started an informal discussion group, "The Iowa Tuesday-at-Noon Hot Air Club." Once again Lewin was able to derive an important research topic from everyday observation. He noticed that people in cafeterias would often reach over pie slices in the front of a counter to choose pieces of pie at the back. One of Lewin's students, Herbert Wright, had the cafeteria staff place identical pie slices in ordered rows. People still usually chose the pieces at the back. The more difficult the pieces of pie were to reach, the more attractive they seemed. Lewin concluded that the effort involved in reaching a goal affects the strength of its positive valence. Even a goal that objectively is of little value can be very attractive, and highly desired, if one must expend a great deal of effort to gain it. Lewin was not the first person to note this: Napoleon had once said that the secret of his success was the discovery that men would die for medals, while Groucho Marx observed that he did not care to belong to any groups whose standards were sufficiently low to admit him.

Lewin and his Iowa students conducted a number of important and widely cited experiments. Barker, Dembo, and Lewin (1941) studied the effects of frustration on the behavior of children. Lewin's *dedifferentiation hypothesis* predicted that under conditions of frustration, behavior should become dedifferentiated and the child should regress to earlier, more primitive, and less constructive behaviors. They tested children between the ages of 2 and 6. First the children spent thirty minutes playing with conventional play materials. The experimenter rated their play for its constructiveness. Then the experimenter lifted a wire screen in the center of the room and encouraged the children to play with some very attractive toys on the other side of the room. After they became totally absorbed with the new toys, the experimenter interrupted their play, led them back to the original part of the room, lowered and padlocked the screen, and observed the children's play with the original toys. Initially, most of the children tried to break through the screen or escape from the room. When these attempts failed, they would often play with the conventional toys, but in a much less constructive manner. Their average play age regressed by seventeen months. Blocks they had earlier used to build towers they now used as missiles, and a toy telephone they had used to make calls they now pounded on the floor; the children cried, whined, and had tantrums, and some even sucked their thumbs. There was a 30 percent increase in hostile reactions to the experimenter and a 34 percent reduction in friendly approaches. Frustration led to both regression and aggression.

In another important series of experiments, Lewin and his students investigated the effects of authoritarian and democratic leadership styles on the behavior of children. In one study, 10-year-olds met eleven times after school to make theatrical masks (Lippitt, 1939). The children were divided into two groups, for which Lippitt played different leadership roles. For one he was very authoritarian, exercising absolute authority, making all decisions and imposing them on the children. For the second group he assumed a democratic role, allowing the children to select activities, accepting their decisions, and letting the majority decide. The different leadership styles and social climates produced striking differences in the two groups. The autocratically led group engaged in far more quarreling and hostility; the children blamed scapegoats for their problems and were less friendly than the children in the democratic group.

In a second, more extensive experiment, Lewin, Lippitt, and White (1939) organized four clubs of 10-year-old boys. The boys engaged in various activities under different styles of adult leadership: authoritarian and democratic as before, but in addition a *laissez-faire* style in which the boys had complete freedom without any adult participation. Every six weeks, each group of boys had a different leader and leadership style. Again, autocratic leadership led to increased aggression, both overtly aggressive acts and more subtle, joking hostility; there was also a sharp increase in aggressive behavior when the autocratic leader left the room. Aggression was also common on the day following the transition from autocratic leadership to a freer atmosphere, and some of the boys became frightened and disturbed when the transition was made. However, with one exception, the boys preferred democratic leadership.

In 1939, Hitler, an authoritarian leader gone mad, led Europe into a terrible war. Lewin, Lippitt, and White's results confirmed Lewin's deep belief in the dangers of authoritarian leaders and the superiority of democratic systems of government. Lewin said later:

> There have been few experiences for me as impressive as seeing the expression on children's faces during the first day under an autocratic leader. The group that had formerly been friendly, open, cooperative, and full of life, became within a short half-hour a rather apathetic-looking gathering without initiative. The change from autocracy to democracy seemed to take somewhat more time than from democracy to autocracy. Autocracy is imposed on the individual. Democracy he has to learn! (Lewin, quoted by Marrow, 1969, p. 127)

Lewin's Applied Research

In 1939, Lewin had an opportunity to return to an earlier interest and conduct what he had come to call *action research* in an industrial setting. Albert J. Marrow consulted Lewin concerning problems his corporation had encountered in opening a new plant in rural Virginia. The 300 employees, mainly women, were eager workers, but management found it difficult to train them to meet the company's production standards. Even after a twelve-week training program, the Virginia workers were only half as productive as the workers in northern plants. This was a problem in worker dynamics that appealed to Lewin. He visited the plant, consulted with the managers, and met the workers. They were well-paid, especially in comparison to local wage rates, yet employee turnover was high.

Lewin organized group problem-solving sessions with the workers. He learned that the company's production standards were widely viewed as impossible to attain. The workers' failure to reach those standards decreased what Dembo had earlier labeled their "level of aspiration." In laboratory experiments, one of Lewin's Berlin students, Ferdinand Hoppe, had found that success or failure on any task increases or decreases the level of aspiration and that this change is general and not limited to the task alone. Lewin set out to make the workers succeed. He organized them into small groups and allowed them to set their own production goals; each group included at least one highly skilled worker to increase the group's chance of success. Production improved slowly, as did worker morale. The workers liked Lewin and were encouraged to discuss his suggestions before deciding to accept or reject them. Discussions between Lewin with his German accent and the Virginians with their southern drawls must have been wonderful to hear. Lewin's work in Virginia is an impressive demonstration of action research in industry (Marrow, 1969, pp. 141–152).

During World War II, Lewin had several opportunities for action research, this time as part of the American war effort (Marrow, 1969, pp. 153–159). He was intensely committed to the defeat of Nazi Germany and gloried in the fact that he had become an American citizen in January 1940, just in time to make a contribution. One of his first studies was done in collaboration with the anthropologist Margaret Mead. It was designed to advise government agencies on ways to alter the eating habits of the American people in consideration of wartime shortages of fresh meats and surpluses of such vegetables as turnips. Lewin compared the effectiveness of a lecture or group discussion in persuading Red Cross volunteers to prepare visceral meats—heart, kidney, and thymus (sweetbreads)—at home. Some volunteers attended a lecture by Mead, who was introduced as a nutritionist from Washington, D.C. Mead stressed the advantages of visceral meats: they were cheap, available, nutritional, and considered to be delicacies in other cultures. Other volunteers attended a group discussion at which the same information was presented and discussed. At the end of each session, volunteers were asked to indicate by a show of hands whether they would be willing to serve visceral meats at home. A follow-up survey several weeks later showed that despite Mead's dynamic lecture, only 3 percent of the lecture group had bought and prepared visceral meats, while 30 percent of the discussion group volunteers had done so (Gray, 1991, p. 549). In Lewin's analysis, the discussion was more effective because it led to a shift in group norms towards acceptance of visceral meats. Once the group members' attitude changed, a change in their behavior followed.

During the war years, Lewin also worked for the Office of Strategic Services on propaganda, military morale, leadership, and the rehabilitation of injured soldiers. During those years he founded the Society for the Psychological Study of Social Issues (SPSSI), serving from 1942 to 1943 as the Society's president. Since its inception, the SPSSI has been active in research and in writing for scholarly publications on such social issues as peace, war, poverty, prejudice, and more recently, family matters (Perlman, 1984). Lewin's frequent trips to Washington during the war years convinced him that his situation in Iowa was too restricted. He had spent nine productive years in the Midwest, but it was time to move on. Lewin concluded that he needed an independent action research institute. With characteristic confidence and energy, he organized the Research Center for Group Dynamics. Edward Tolman (Chapter 13) invited Lewin to locate his center at Berkeley, but despite the attractions of California, Lewin established it on the campus of America's major engineering and technological university, the Massachusetts Institute of Technology (MIT). He recruited a staff, all of whom were under 35 years of age, and attracted students from MIT, Harvard, and other universities in the area.

In 1945, Lewin and his group decided to work in four major program areas. First they sought to find ways to increase group productivity and counter the well-known tendency for groups to be inefficient and to stray from their original goals. Lewin did not want any of his groups setting out to design a horse and ending up with a camel. Second, they designed studies of communication and the spread of rumor. Third, they explored the areas of social perception and interpersonal relations, along with group membership and individual adjustment. Fourth, the group initiated studies in leadership training, which led to the formation in 1946 of the National Training Laboratories in Bethel, Maine, and the beginning of training, or T, groups. These groups were designed to develop effective leadership, open lines of communication, and combat prejudice and destructive attitudes. They have been used widely in educational, counseling, industrial, and clinical settings.

Lewin was also involved in forming a second major research institution, the Commission on Community Interrelations (CCI), for the American Jewish Congress. Lewin had experienced anti-Semitism in Germany, and his mother had died in a Nazi concentration camp. He hoped to organize programs to combat racial and religious prejudice, confront social issues, study them objectively, and make recommendations for their solution. The Commission, headquartered in New York City, conducted important research, including studies of discrimination in hiring and employment. At the time, most department stores in the United States refused to hire black sales clerks because they believed their customers would not stand for it. Two CCI investigators, Gerhart Sanger and Emily Gilbert (1950), interviewed customers in one of the few New York City department stores employing clerks of both races after the customers had been served by either black or white sales clerks. They found that antiblack prejudice had no effect on sales. To the question "What would you think if all New York department stores hired Negro sales persons?" 64 percent of the shoppers and 75 percent of people interviewed on the street said they approved of black sales clerks being hired. A dozen respondents expressed extreme prejudice and said they would not shop in a store that employed black sales clerks, yet five of those people had been served by a black sales clerk and had continued to shop in that store. Lewin and his students found that for the majority of shoppers, the knowledge and courtesy of the sales clerks, not their race, was crucial. These findings were widely publicized in the 1950s to combat racial discrimination in employment.

A second CCI study investigated the effects of segregated and integrated housing on racial attitudes. Though Lewin planned the study, it was actually carried out after his death by Morton Deutsch and Mary Evans Collins (Marrow, 1969, pp. 208–210). They interviewed 100 white and 25 black housewives and 24 teenage boys and girls living in four housing projects in New York City and Newark. The projects were physically identical, but two were completely integrated and two were partially segregated—that is, integrated in a "checkerboard" pattern, with whites and blacks living in alternate buildings. In the partially segregated projects, prejudice against blacks was stronger and sharper than it was in the fully integrated projects, and the white residents in these projects expressed a strong preference for still more segregation. People in the more integrated projects had a greater sense of community; they exhibited less prejudice and better morale. The white residents of integrated projects expressed pride in the open character of their buildings and were less suspicious and hostile than the people in the segregated buildings. Contrary to the popular belief that any building with a black occupancy rate above 50 percent would have trouble, the investigators found that the most cordial relations existed in an integrated project with 70 percent black occupancy. These were important and politically significant findings that would be central to debates in the 1950s and 1960s over equal occupational and housing opportunities for blacks in the United States.

Under Lewin's leadership, the CCI was involved in a third significant educational and social development. In the early 1940s, American universities and colleges used admission quotas that placed limits on the number of Jewish

The Lewin Tradition in Psychology

At the University of Berlin in the 1920s, the University of Iowa in the 1930s and early 1940s, and at the Masssachusetts Institute of Technology for the rest of his life, Kurt Lewin was able to bring together remarkably effective groups of students and research associates. In three very different environments, Lewin's groups of psychologists worked together with great success. Lewin also trained a cohort of students who went on to prominence. A citation analysis of social psychology texts (Perlman, 1984) shows the strength of Lewin's legacy. Eight of the ten most cited social psychologists are part of the Lewin tradition. The roster of names of Lewin's students and associates, psychologists he influenced, and students of his students includes many of the leading social psychologists of recent decades:

Eliot Aronson	Robert Krauss
Kurt Back	Judson Mills
Roger Barker	Albert Pepitone
Dorwin Cartwright	Lee Ross
John Darley	Stanley Schachter
Tamara Dembo	Peter Schonback
Morton Deutsch	Harold Sigall
Leon Festinger	Jerome Singer
Neil Grunberg	John Thibaut
Edward E. Jones	Alvin Zander
Harold Kelley	Phil Zimbardo

Shelley Patnoe (1988) interviewed all these psychologists except Dembo as part of a narrative history of experimental social psychology. Patnoe asked them to describe their experience in working with Lewin and to speculate as to why Lewin had been so successful as a teacher, motivator, researcher, and theorist. Their interviews provide many valuable insights:

1. It is clear that research with Lewin was a highly social activity, not the lonely, isolated endeavor of popular myth. Lewin himself wrote that he was incapable of thinking productively as an individual (Lewin, 1936, p. 16). One of his first Berlin students, Anitra Karsten, reported that working with Lewin was "one long discussion" (Karsten, 1978, in Ash 1992, p. 201). Lewin actively sought intellectual communion and stimulation from others.
2. There are deep and profound links to Lewin among many leading social psychologists. Lewin became the Pied Piper of social psychology, attracting outstanding students wherever he worked. Though the term *Lewinian* would probably have struck him as hilarious, those who worked with him shared his characteristics and approach to psychology.
3. Lewin's style was one of interdependence and cooperation. At all three universities, students remembered the regular group meetings at which they discussed research problems

students allowed to enroll. Folk wisdom at the time held that "you can't legislate goodwill," but since Lewin had found in his research that attitudes can be changed by changing behavior, he encouraged the American Jewish Congress to challenge the quota system. The Congress filed suit against the Medical School of Columbia University, charging discrimination in Columbia's admission procedures. The case became front-page news, was a great embarrassment to the university, and forced its administration to open its admissions records for inspection. Following Columbia's lead, other universities revised their admission procedures. The CCI also supported a study of what Lewin, who was

The Lewin Tradition in Psychology (Continued)

and findings. Lewin described these meetings as *die Quasselstrippe* (the chatter line). But it is clear that they were much more than mere chatter. The discussions were open, task-centered, both exhausting and stimulating. They were very much a discussion among equals in which ideas and empirical tests mattered, not rank, status, or prestige. The atmosphere was that of an intellectual free-for-all or brainstorming session.

4. Lewin's *topological theory* provided a framework for the discussions and for the research that followed. His theoretical framework was not rigid or constrained. It stood in contrast to the conditioning and learning theory of the other major theorist and "dream merchant for graduate psychology students at Iowa, Kenneth Spence" (Chapter 13; Kendler, 1989, p. 1126). Nevertheless, Lewin's theory served to direct and organize their research.
5. Many of those interviewed vividly remembered Lewin's enthusiasm, confidence, and dedication. In turn, many of his associates developed those qualities themselves.
6. Lewin welcomed unconventional and novel ideas. In his early days at Iowa, Lewin had difficulty grasping the meaning of the colloquialism "to stick one's neck out." But once he understood its meaning, he knew it was exactly what he wanted his colleagues to do (Thompson, 1978). As we have seen, Lewin himself had a great talent for translating everyday observations into important research themes. Often Lewin was unconventional. John Thibaut remembered him advising his students, "Don't read psychology, read philosophy or history or science, poetry, novels, biographies—those were the places you would get ideas. Psychology at this point—it will stifle your imagination" (Thibaut, in Patnoe, 1988, p. 56).
7. Lewin was able to integrate and reconcile the different and sometimes conflicting approaches of basic and action (applied) research. After his death, the differences between basic and applied research became so profound that the two groups split with the Research Center for Group Dynamics, the Research Center for Group Dynamics moving to the University of Michigan and some of Lewin's original group remaining at MIT.

The deep respect and affection for Lewin that so many prominent psychologists show is testimony to his outstanding qualities. Lewin's legacy and place in the history of psychology are both secure.

never one to mince words, called *Ways of Handling a Bigot* (Selltiz, Citron, Harding, Rosahn, & Wormser, 1950). They used role-playing in a series of playlets presenting different versions of an incident. In each case an actor expressed an extremely prejudiced or bigoted opinion. In the first playlet, his remarks went unanswered; in the second, they were answered quietly; and in the third, they were answered angrily with an emotional, threatening reply. Subjects preferred the calm answer 65 percent of the time, and significantly, 80 percent of the audience stated that they wanted to see the bigot challenged. When this happened, the audience usually supported the challenger.

Lewin died suddenly of a heart attack on February 1, 1947, having been hard at work up to the evening of his death. In a memorial address at that year's APA convention, Edward Tolman said of him:

> Freud the clinician and Lewin the experimentalist—these are the two men whose Names will stand out before all others in the history of our psychological era. For it is their contrasting but complementary insights which first made psychology a science applicable to real human beings and real human society. (Tolman, 1947, in Marrow, 1969, p. ix)

When Heyduk and Fenigstein (1984) surveyed eminent psychologists, they found that Freud and Lewin were most frequently named as significant influences on their psychological development. This finding provided a striking confirmation of Tolman's prediction.

Gestalt Psychology and Gestalt Therapy

Gestalt therapy is often thought to derive from *Gestalt psychology.* At best, that relationship is tenuous. The principles and methods of *Gestalt* therapy were first outlined in *Gestalt Therapy: Excitement and Growth in the Human Personality,* published in 1951. None of the three authors—Fritz Perls, Ralph Hefferline, and Paul Goodman—had any background in Gestalt psychology. Perls worked as a neuropsychiatrist in Germany, Austria, Holland, and South Africa. He emigrated to the United States in the late 1940s, establishing a practice in New York City (Greenberg, 1997, p. 196). Hefferline was a professor of psychology at Columbia University. He was a behaviorist (Skinnerian) psychologist best known for his 1959 report on escape and avoidance conditioning of minute muscle movements in the thumb (Hefferline, Keenan, & Harford, 1959). Paul Goodman was a poet, playwright, fiction writer, and social critic. In his later books, *In and Out of the Garbage Pail* (1969) and *The Gestalt Approach and Eyewitness to Therapy* (1973), Perls described his approach to therapy as radical and invited the reader to "invade" his or her "privacy" and through "self-discovery" observe the "self in action." Perls often used terms derived from *Gestalt* psychology such as *insight* and *closure.* He further asserted that his therapeutic approach derived "from a science which is neatly tucked away in our colleges; it comes from an approach called *Gestalt* psychology" (Perls, 1969, p. 61).

The historical connection Perls claimed between *Gestalt psychology* and *Gestalt therapy* has since been rejected. Perls himself acknowledged that he was never accepted by the *Gestalt* psychologists and admitted he had never read their books. Nevertheless, Perls dedicated one of his books on *Gestalt* therapy to Max Wertheimer. Wertheimer did not live to see the dedication, but Rudolf Arnheim described what his reaction might have been. "I can see Max Wertheimer fly into one of his magnificent rages had he lived to see one of the more influential tracts of the therapeutic group in question dedicated to him as though he were the father of it all" (Arnheim, 1974, p. 570). Hefferline described *Gestalt* therapy as "misleadingly entitled" and remembered that when a prepublication copy of the book had been presented to Köhler, he had disavowed the idea that it was in any way a legitimate descendant of *Gestalt psychology* (Knapp, 1986b, p. 54). Mary Henle, herself a *Gestalt* psychologist and historian of psychology, examined the relationship between *Gestalt* psychology and *Gestalt* therapy and concluded:

> What Perls has done has been to take a few terms from *Gestalt* psychology, stretch their meaning beyond recognition, mix them with notions—often unclear and incompatible—from the depth psychologies, existentialism, and common sense, and he has called the whole mixture *Gestalt therapy.* His work has no substantive relation to scientific *Gestalt* psychology. To use his own language, Fritz Perls has done "his thing" whatever it is, it is not *Gestalt* psychology. (Henle, 1978b, p. 31)

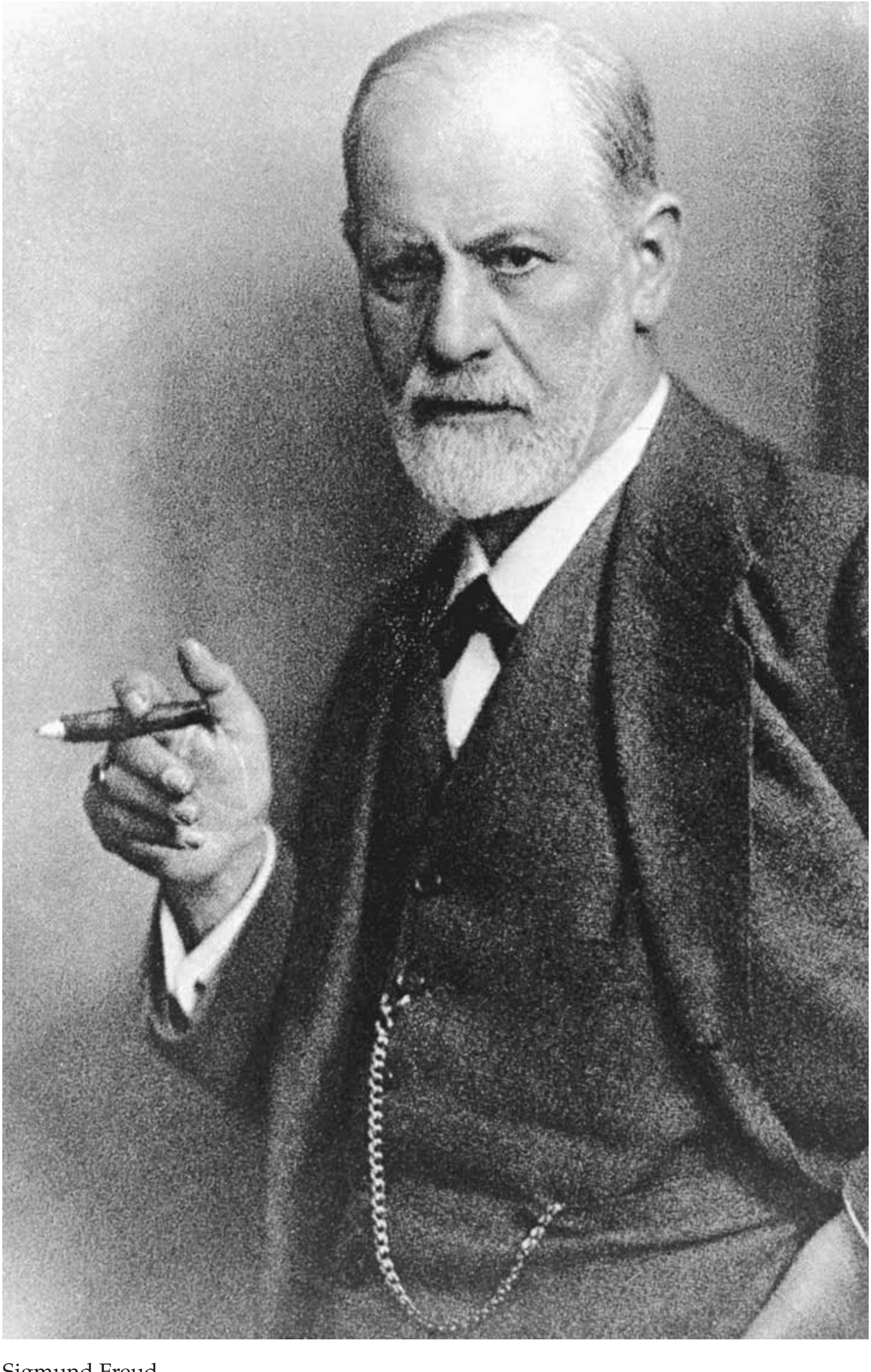
In 1986, Henle stated, "The most grotesque misunderstanding of *Gestalt* psychology is the notion that it has some relation to *Gestalt* therapy. . . . [I] will merely state that there is nothing in common between these two developments" (Henle, 1986, p. 121). Greenberg (1997) gave a less critical evaluation of the historical link between *Gestalt* psychology and *Gestalt* therapy:

> Although it was unclear at the time, *Gestalt* therapy's tenuous alliance with *Gestalt* psychology, by the adoption of its name (an alliance opposed by Köhler) was intellectually a good one. Both *Gestalt* psychology and *Gestalt* therapy were interested in perception and both were attempting to understand conscious experience. Just as *Gestalt* psychology served as a foundation stone for modern cognitive science, so too does *Gestalt* therapy serve as a foundation stone for modern experientially based dialectical-constructivist views of psychotherapy. (Greenberg, 1997, p. 197)[9]

GESTALT PSYCHOLOGY IN PERSPECTIVE

Despite Tolman's praise of Lewin in 1947, field theory has not received nearly the same amount of attention as Freud's psychoanalytic theory has. Nor has *Gestalt* psychology, the conceptual basis of field theory, ever become a major school of American psychology. Köhler felt that *Gestalt* psychologists' impact was limited since they were interested primarily in perception, while American psychologists were interested primarily in learning (Wallach, 1976). To some extent that is true, since *Gestalt* psychology is often presented within the framework of perceptual theory. However, Köhler was obviously interested in learning, albeit a qualitatively different type of learning from what the American psychologists were studying (Chapters 11 and 12). Also, Wertheimer's book *Productive Thinking* concerned itself entirely with the process of teaching complex concepts to children, and so it would not be inaccurate to say that he was interested in learning and cognition as well. Today, with the rising interest in cognitive psychology, the research of Köhler and Wertheimer has become relevant again. Also, ideas spawned by Lewin's diverse and innovative *Gestalt* approach are echoed in much contemporary research in social, industrial, rehabilitation, and developmental psychology.

[9] Contributions to clinical psychology derived from *Gestalt* principles, and especially from Lewin, are described in Stivers & Wheelan (1986), pp. 70–112.



Sigmund Freud.
(National Library of Medicine)

CHAPTER 8

The History of Clinical Psychology and the Development of Psychoanalysis

In this chapter, we turn from trends and developments in experimental psychology to the history of clinical psychology and the contributions of Sigmund Freud. In an excellent description of the historical and research foundations of clinical psychology (Walker, 1991), various contributors point out that while clinical psychology is an even younger discipline than psychology itself, its roots are ancient. Throughout history, philosophers, theologians, priests, ministers, rabbis, shamans, friends, and relatives have confronted various forms of mental illness and attempted to overcome them. References to phobias and anxiety states are found in the earliest recorded history. Hippocrates (Chapter 1) diagnosed and treated mania, melancholia, paranoia, and hysteria. He challenged the belief that epilepsy was a divine or sacred disease, attributing this belief to people who feared epilepsy and did not understand it. But, he argued, if all that we do not understand was labeled divine, then there would be no end of divine things. Antiphon, a contemporary of Socrates, treated grief and melancholy with Socratic methods. In the Bible, the Lord reduces King Nebuchadnezzar of Babylon to bestial madness (Daniel 4:31–37). The Bible describes many mental and behavioral disorders and even an early personality test in which Gideon selected his soldiers on the basis of both how much fear they reported and how they drank water from a stream—by lapping it up or using their hands (Marchman, 1993, p. 20). St. Augustine in his *Confessions* described the temptations of a mistress and gave thanks to God that he was not responsible for the contents of his dreams. The historical record of the awareness of psychology and mental illness is long and diverse. But it was only in the eighteenth century that the first systematic reforms were made in the care and treatment of the mentally ill and only in 1896 that clinical psychology was established as part of psychology.

Despite its short history, clinical psychology is now a central area of psychology. From 1975 to 1980, all five presidents of the APA were clinical psychologists. In 2002, Division 12, the Clinical Psychology Division of APA, was the largest division, with over seven thousand members. The clinician's role is most often associated in the public mind with psychology. In this chapter, we will pay particular attention to the revolution in the care and treatment of the mentally ill that occurred in the nineteenth century. We will also outline the life and work of Sigmund Freud, the founder of psychoanalysis.

EARLY VIEWS OF MENTAL ILLNESS

During most of recorded history, the plight of the mentally ill was desperate. While some Greek and Roman physicians made an attempt to understand mental illness (Chapter 1), the decline of Greco-Roman civilization saw a retreat from the relatively enlightened views of such men as Hippocrates, Antiphon, and Galen. People who today would be diagnosed as mentally ill were treated as wicked and punished for their sins. Martin Luther in his *Table Talk* (1652) described the feebleminded as godless people, possessed by the devil. Having neither reason nor souls, they were permanently doomed. Furthermore, since the mentally disturbed did not behave like normal people, for centuries they were regarded as nonhuman and subjected to barbaric abuses. Such individuals also served as convenient scapegoats when inexplicable calamities such as plagues befell communities.

Delusions of grandeur, hallucinations, and other pathologies undoubtedly underlay the behavior of the "mad" popes, kings, and tyrants over the centuries. The Maid of Orleans, Joan of Arc, heard voices that inspired her military adventures; but after her defeat, they led to her trial by the English on charges of witchcraft, heresy, and sorcery. Joan of Arc was found guilty and burned at the stake in 1431. The equation of witchcraft with mental disorders was a tragic aspect of life in the Dark and Middle Ages.

Witchcraft in Europe

The definitive work outlining the characteristics, identification, and punishment of witches was the *Malleus Maleficarum* (Hammer of the Witches), first published in the late 1480s. An excursion into a terrifying world of sadism and cruelty, the book became an incitement to torture and mass murder. Hundreds of years later, in the nineteenth century, Carl Binz described this book:

> It is a heavy volume in quarto, so insane, so raw and cruel, and it leads to such terrible conclusions, that never before or since did such a unified combination of horrible characteristics flow from a human pen. (Binz, 1885, p. 10)

Ironically, the book was written to improve society and protect people from the wickedness and depravity of witches. Its authors were two German Dominican priests, James Sprenger and Heinrich Kramer. Before publishing their book they obtained the backing of the Pope in December 1484; the support of Maximilian, the king of Rome, in 1486; and, finally, endorsement from the faculty of theology of the University of Cologne in 1487. With these papal, regal, and academic imprimaturs, *Hammer of the Witches* became a textbook of the Inquisition. Zilboorg and Henry described its impact:

> It went through ten editions before 1669 and through nine before another century passed. Bookmaking was not as efficient in those days as it is in ours, nor

> was literacy a characteristic of the age; thus, nineteen editions stand out as imposing and incontestable testimony not only of the popularity of the book but to the great need of the time which it undoubtedly filled. (Zilboorg & Henry, 1941, p. 152)

A translation by the Reverend Montague Summers was published in 1928, and a *Compendium Maleficarum* edited by Francesco Guazzo appeared as recently as 1970.

The *Hammer* had three main sections. The first section provided proof that witches exist and explanations for their actions. Witches fly after rubbing on their bodies a Satanic salve of consecrated wafers fed to toads. The toads are burned, and their ashes are then mixed with the powdered bones of a hanged man and the blood of a newborn infant to form the salve. To question these proofs was heresy, punishable by the full authority of the Church in this world and the next. The second section provided descriptions of the characteristics and actions of witches. From a psychological point of view, this is the most interesting section. It is clear from the text and from the evidence presented at the trials of accused witches that many of them were mentally ill. Descriptions of delusions, hallucinations, manic and melancholic behavior, catatonia, and paranoia were frequent. Often these precise descriptions were based on careful observation, but that did not lead to accurate explanations of the behavior. The *Hammer* decreed that witchcraft springs from carnal lust, which is never satisfied in women, and so it is no surprise that girls and women were almost always the accused. Some women, hungering after ever more intense gratification, sought it from the devil and were bewitched.

The third section of the *Hammer* outlined how to examine witches and ensure full confessions. Accused witches were tortured first with "more gentle" techniques and then, if they resisted, with techniques of extreme cruelty and sadism. Accused witches were tied and lowered into cold water; if they floated, they were guilty of Satanic possession, and if they sank and drowned they were innocent. Having chosen of their own free will to consort with the devil, women were to confess their witchcraft both in the torture chamber and in a place removed from the instruments of torture. This double confession constituted the final proof of guilt. Since people believed that no natural power could overcome witchcraft, the usual outcome of such a confession was death by hanging, burning, or drowning. From the early decades of the fifteenth century until the middle of the seventeenth, between 200,000 and 500,000 witches, 85 percent of whom were girls and women, were executed in Europe (Harris, 1975; Ben-Yehuda, 1980).

Witchcraft in the New World

Belief in demonology and witches was not limited to Europe but spread to the New World. The villagers of New England kept a close watch on each other and were ever alert to the devil and his works. The best-known American witch trials were held in the village of Salem (now Danvers), near Boston, Massachusetts, in 1692. Before the Salem trials, accusations of witchcraft were common in New England, but the outcomes of witch trials usually favored the accused, and there were only five executions of accused witches in Massachusetts before 1692 (Kittredge, 1929).

The crisis in Salem began suddenly in December 1691, when eight young girls developed disorderly speech, hallucinations, odd postures, bizarre gestures, and convulsive fits. Physicians were unable to explain or cure their illness, which was finally diagnosed as being due to bewitchment. First the girls accused a Barbadian slave living in Salem and then the pipe-smoking, muttering Sarah Good as being the women who had bewitched them. A month later, the girls' condition had not improved, and they made further accusations against two pious Salem women of good standing and reputation. Accusations of witchcraft against 115 local people followed. They were tried as witches in the spring and early summer of 1692. The first woman condemned as a witch was hanged in June, and by September nineteen men and women had been sent to the gallows. One man who defied the magistrates and refused to admit his guilt was pressed to death with stones. The girls participated in the trials, testifying against the accused witches and creating an uproar with their wild and disordered behavior. The magistrates regarded their behavior in court as "spectral evidence" of their bewitchment. Many of the people they accused of witchcraft were respectable and upstanding citizens of the village, including a former minister of Salem.

The madness at Salem ended as suddenly as it had begun, and by the end of 1692 the witch trials were over. The following spring, the governor of Massachusetts released 150 accused witches who had been imprisoned. The witchcraft laws were rewritten, and witchcraft became a crime that was almost impossible to prosecute. What caused this outbreak of community madness in Salem? A number of explanations have been proposed. The girls might have behaved as they did to gain attention normally denied them or to take revenge on people they did not like. The afflicted girls held power over their elders and over the community at large. No minister, magistrate, master, or mistress was safe from their accusations. Once the accusations began, the girls could not escape from the terrible trap they had created. One advocate of this position has suggested that the young girls of Salem were "no more seriously possessed than a pack of bobby-soxers on the loose" (Starkey, 1950, p. 29). On the other hand, some authors explain the outbreak as having been due first to the girls' hysteria, and then to a more general community hysteria.

One psychologist, Linnda Caporael (1976), claimed that convulsive ergotism might have been the physiological basis of the girls' behavior. Ergot poisoning is caused by a fungus that grows on damp grain crops, especially rye. Lysergic acid is a natural product of the ergot fungus. Convulsive ergotism produces symptoms that closely match those exhibited by the young girls of Salem: convulsions, sensations of being pricked or bitten, temporary blindness or deafness, and speechlessness. Rye was a staple of the early New England diet, and Caporael found that the cool, damp weather conditions of the summer and autumn of 1691 would have been ideal for the development of the ergot fungus. Caporael regarded the geographical distribution of the afflicted girls' homes, their symptoms, and the timing and duration of the crisis as consistent with her theory of ergot poisoning. Caporael went on to suggest that the fungus might have been involved in other outbreaks of witchcraft. Nicholas Spanos and Jack Gottlieb (1976) challenged her conclusions, claiming that the girls had been role-playing. However, Mary Matossian (1982), after examining the court records of the Salem trials along with climate and crop records, supported Caporael's conclusion that an outbreak of ergotism may have been responsible for the behavior of the girls of Salem.

EARLY INSTITUTIONS AND "CURES" FOR MENTAL ILLNESS

If they were not tried as witches, many retarded and mentally ill people before the nineteenth century were treated as common criminals and thrown into prisons or locked up in "fools' towers," "fools' homes," or "lunatic asylums." In 1330, a convent of the order of St. Mary of Bethlehem became the first institution for the mentally ill in England. In 1543, King Henry VIII granted a royal charter for an asylum for the mentally deranged at the Hospital of St. Mary of Bethlehem. This institution became known to the Cockneys of London as "Old Bedlam" through a corruption of its name—Bethlehem to Bethl'em and then Bedlam. The modern meaning of the word *bedlam*—"a scene of wild uproar and confusion" (RHDEL, p. 133)—describes the prevailing conditions at the hospital. Inmates were chained, whipped, and beaten; fed only slop; given purges and emetics; and subjected to bloodletting. Their keepers were not paid, but earned small fees by displaying their charges for the entertainment of the general public. A visit to Old Bedlam to see the mad men and women was considered a pleasant outing, as was chronicled by William Hogarth in a painting of a scene from the *Rake's Progress* in which two elegantly dressed and coiffed ladies visit Bedlam to see the sights. Jonathan Swift in *A Tale of a Tub* depicted the interior of Bedlam. As late as 1814, 96,000 people each paid a penny to visit St. Mary's (Gleitman, 1987, p. 493). Before the nineteenth century, wild animals were considered too frightening for members of the general public to see and so were kept in private collections. Today, mentally ill people are secluded, and animals are displayed in zoos. Melancholic and depressed patients whose behavior did not make a good show were sent out into the streets of London wearing badges that authorized them to beg for their keep. These "Toms of Bedlam" were well-known in London (Silverberg, 2001). In William Shakespeare's *King Lear*, Edgar enters "like the catastrophe of the old comedy: my cue is villainous melancholy, with a sigh like a Tom o'Bedlam" (Act 1, scene 2).

A group of British historians has challenged this picture of conditions at St. Mary of Bethlehem Hospital (Bynum, Porter, & Shepherd, 1985; Porter, 1987). They assert that only a very small number of people were institutionalized and that conditions were not as bad as they are often described. They also claim that inmates were seldom exploited or abused. These authors consider the charge for admission to have been a collection of Christian alms rather than the price of admission to an entertainment. Restraint, manacling, and chaining were used only with violent and assaultive inmates and only when all else failed. James Norris was restrained with an iron collar and chained to the wall behind his bed, but only after four years of milder treatments had failed. These historians also point out that Norris was given books and newspapers to read and was allowed the company of a pet cat.

James Norris shackled in his cell in Bedlam.
(Mary Evans Picture Library/Photo Researchers)

The historians' critiques are lively and often acerbic, but ultimately unconvincing. The back wards of the Central Ohio Lunatic Asylum, opened in 1877 and typical of American institutions of that time, were fitted with iron bars and chains to restrain and manacle inmates. Such conditions were in fact common both in the United States and in England. In 1814, Ebenezer Haskell forced his way into St. Mary of Bethlehem and reported to the British House of Commons what he had seen:

> In the women's galleries, one of the side rooms contained about ten patients, each chained by one arm or leg to the wall, the chain allowing them merely to stand up by the bench or form fixed to the wall, or to sit down on it. The nakedness of each patient was covered by a blanket, made into something like a dressing gown, but with nothing to fasten it in front. This was the whole covering, the feet being naked. In another part I found many of the unfortunate women locked in the cells, naked and chained on straw, with only one blanket for covering. In the men's wing, in the side room, six patients were chained close to the wall, five handcuffed and one locked to the wall by the right arm, as well as by the right leg; he was very noisy; all were naked except as to the blanket, gown, or small rug on the shoulders, without shoes—their nakedness and their mode of confinement gave this room the complete appearance of a dog-kennel. (Haskell, cited by Roback & Kiernan, 1969, p. 192)

In 1815, the British Parliament appointed a Select Committee to investigate conditions at St. Mary of Bethlehem. Their report documented and exposed the dreadful conditions there (Andrews, 1997). Fifty years later, Charles Dickens, in a speech to the Newsvendors Benevolent Institution, summarized press reports on the treatment of the mentally deranged:

> The newsman brought to us daily accounts of a regularly accepted and received system of loading the unfortunate insane with chains, littering them down on straw, starving them on bread and water, denying them their clothes, soothing them under their tremendous affliction with the whip, and making periodical exhibitions of them at small charge, rendering our public asylums a kind of demoniacal Zoological Gardens. (Dickens, May 9, 1865, in Ackroyd, 1990, p. 136)

As Dickens reported, at times inmates were starved, with the impact increased by suspending the victim in a basket over the table at which others ate. Water "cures" meant dumping as many as a hundred buckets of ice-cold water over a chained inmate. In the "whirling cure," the person was strapped to a bed or chair that was rotated rapidly at speeds up to 100 rpm.[1] This technique was popular both in England and in the United States. In 1811, an American physician, Joseph Mason Cox, published *Practical Observations on Insanity and Some Suggestions Towards An Improved Mode of Treating Diseases of the Mind.* Cox was an enthusiastic advocate of whirling, swinging, and rotation in treating mania. He reported that when given in the dark:

> A very few circumvolutions [rotations] produces soothing, lulling effects, tranquilizing the mind and rendering the body quiescent; a degree of vertigo has followed, which has been succeeded by the most refreshing slumber; an object the most desirable in every case of madness, and with the utmost difficulty procured. (Cox, 1811, p. 1)

While Cox reported that some patients violently resisted being placed in the swing, he had used it with numerous manic patients and had seen "very surprising changes." In one "most miserable patient," a single application of swinging produced "the most complete revolution in the mind, changing the whole train of ideas" (Cox, 1811, p. 12).

Until the twentieth century, many physical illnesses were thought to be caused by disorders of the blood, so a common procedure was to let or remove blood by applying leeches or making venous incisions. Both physicians and barber-surgeons performed those procedures. In fact, the red and white barber's pole was originally the sign of a bloodletting barber-surgeon. In 1667, a physician named Denis withdrew ten ounces of blood from a melancholic patient and replaced it with six ounces of blood from a calf. Denis reported that the patient's mind cleared and he recovered from his melancholy (Zilboorg & Henry, 1941, p. 275). At St. Mary of Bethlehem, patients were bled routinely in the spring and autumn every year.

Benjamin Rush (1745–1813), the father of American psychiatry and a man whose silhouette appears on the seal of the American Psychiatric Association, was an enthusiastic advocate of bloodletting. In 1793, a severe yellow fever epidemic struck Philadelphia. More than four thousand people died, and at one point Rush was one of only three physicians remaining in the city. He

[1] A collection of such devices is housed at the Museum of the History of American Psychiatry in St. Joseph's, Missouri.

showed great courage in staying with his patients, but the purgings and bleedings he administered undoubtedly killed many of them. When Rush himself was struck with a violent fever, he instructed his assistants to bleed him plentifully. They did, and Rush almost died. But when he, along with some of his patients, recovered, Rush recalled:

> Never before did I experience such sublime joy as I now felt in contemplating the success of my remedies—the conquest of a formidable disease through the triumph of a principle of medicine. (Rush, quoted by Eisenberg, 1977, p. 1106)

Rush's principle was derived from the *Brunonian* system of medicine, which taught that excessive stimulation and excitement of the blood produce both physical and mental illness. Thus, bloodletting would "quiet the blood" of both the physically and mentally ill. Rush, however, was not without his critics. The English journalist William Cobbett likened bloodletting to "one of those great discoveries which have contributed to the depopulation of the earth." Rush sued for libel, and Cobbett was forced to pay damages of $8,000 (Middleton, 1928, p. 434). Rush was instrumental in founding a wing for the treatment of the insane at the Pennsylvania Hospital in Philadelphia. His belief that the insane deserved treatment was enlightened, but the treatments he used—bloodletting, near drowning, twirling and whirling, fright and terror to shock the insane back to a state of sound mind—were often barbaric (Fox, Miller, & Miller, 1996).

REFORMATION OF INSTITUTIONS FOR THE MENTALLY ILL

Phillipe Pinel (1745–1826)

Pinel is often described as the father of scientific psychiatry. He was a quiet, shy person who lived before, during, and after the French Revolution. Inspired by the revolutionary ideals of liberty, equality, and fraternity, Pinel aimed to provoke a revolution in the care and treatment of the insane. Pinel's was a family of physicians, and he received a medical degree in 1773 from the University of Toulouse. He worked as a tutor and took additional courses in medicine, history, and Greek philosophy while obtaining a second degree in philosophy from the University of Montpellier. He then practiced medicine, but became disenchanted with what he saw as the greed, meanness, and intrigues of his fellow physicians. He moved to Paris and served the city's poor rather than the wealthy bourgeoisie he despised (Reisman, 1966).

Pinel also became progressively more interested in insanity, an interest that was stimulated in 1783 when a close friend, a young man of 24, consulted him for help with his nervous condition. The man was a law student in Paris who had frequent periods of mania and depression. One day he would excitedly describe his plans for a brilliant legal career and the next he would fall into a deep depression, unable to leave his room, eat, or sleep. Pinel tried to help him, but one night in a fit of despair the young man fled from his father's house wearing nothing but a shirt, got lost in a nearby forest, and was attacked and killed by wolves. That dreadful accident moved Pinel deeply. Why had he, a physician, been unable to comfort and heal this poor man? What caused such behavior? What could be done to overcome attacks of insanity?

Pinel resolved to take every opportunity to study the insane. He consulted with experts and read the literature on insanity. He found most of the opinions of the experts worthless, but the works of Joseph Daquin (1733–1815) struck a responsive chord. Daquin believed insanity was a disease that must be understood and treated by the methods of natural science. The insane were not depraved animals, but sick people who needed treatment. "To look at a madman and be amused," Daquin said, "was to be a moral monster" (Daquin, quoted by Zilboorg & Henry, 1941, p. 318). Pinel and Daquin became mutual admirers, and when Daquin published the second edition of *Philosophie de la Folie* (Philosophy of Madness) in 1793, he dedicated it to Pinel.

With Daquin's encouragement, Pinel began to write articles on insanity and entered an essay in a contest sponsored by the Royal Society of Medicine entitled "The Best Method of Treating Patients Who Become Insane Before Old Age." In it, he argued that such people need humane treatment, sympathy, and guidance, not the beatings, imprisonment, and ridicule they so often suffered. His paper received honorable mention and brought his name to the attention of one of the judges, Thouret, the prefect of the Faculty of Medicine of Paris. After the revolution, Thouret was appointed to a board to oversee Parisian hospitals. Knowing Pinel's interest and enlightened views on insanity and the parlous state of his medical practice, Thouret arranged for Pinel's appointment as director of the Bicêtre Asylum in Paris beginning in 1793. Originally a prison, the Bicêtre had become a home for the poor and then, in 1660, a retreat for the insane. The position as director was far from desirable, but Pinel accepted it with enthusiasm. First he reviewed the commitment papers of all the inmates, and then he toured the building, meeting the inmates individually and observing their behavior. Most were manacled, and archers patrolled the Bicêtre's walls to prevent escape. Pinel described what he saw:

> On my entrance upon the duties of that hospital, everything presented to me the appearance of chaos and confusion. Some of my unfortunate patients laboured under the horrors of a most gloomy and despondent melancholy. Others were furious and subject to the influence of perpetual delirium. Some appeared to possess a correct judgment upon most subjects, but were occasionally agitated by violent sallies of maniacal fury; while those of another class were sunk into a state of stupid idiotism and imbecility. (Pinel, 1801, pp. 1–2)

Pinel decided that his first act would be to remove the physical restrictions from many inmates. Kindness and humane treatment would replace manacles and abuse. Before taking these steps, Pinel had to gain the permission of the Revolutionary Council in charge of the Paris Commune. He stated his case and described his plan before the council and its president, a crippled revolutionary named Georges Couthon. After Pinel had completed his presentation, Couthon said, "Citizen, you must be crazy yourself to let those brutes loose," and sarcastically remarked that Pinel's next step would be to go to the zoo and

Phillipe Pinel orders the removal of an inmate's chains at the Bicêtre.
(The Bettmann Archive)

liberate the lions and tigers (Roback & Kiernan, 1969, p. 194). Pinel persisted, and finally Couthon agreed to visit the Bicêtre. His attempts to question the inmates met only curses and threats of violence. Couthon concluded that Pinel must be mad to consider unchaining such people, but he gave the doctor permission to do what he thought best. Couthon felt sure that Pinel himself would be the first victim of this action.

Pinel is usually given credit for being the liberator of the insane, but eight years earlier Vincenzio Chiarugi had outlawed chains as a means of restraint in Italy. He believed that most madness was acquired rather than inherited, and as such could be treated. Chiarugi's first step was to establish humane management (Gerard, 1997). But Pinel's actions were more extensive and better documented. Pinel's dramatic move was depicted in a famous painting by Charles Muller showing Pinel ordering the removal of the chains. This painting is somewhat misleading, for Pinel actually proceeded in a cautious and systematic manner. Starting in 1793 with a small number of inmates, he observed carefully the effects of removing their fetters. The first man unchained was an English officer who had been at the Bicêtre for forty years, a vicious and violent man who had crushed a guard's head with his manacles. Pinel spoke quietly to him, asking if he would promise to be calm and not hurt anyone. The man agreed, and after his chains were removed he walked into the courtyard, gazing in ecstasy at the sky he had not seen for all those years. He shunned all violence, helped care for the other inmates, and was released after another two years. Another man unchained that dramatic day was Charles Chevigné, a former soldier kept in chains because of his legendary strength and violent nature. Ten years earlier, Pinel had seen him being taken in a cart through the streets of Paris to the Bicêtre. Pinel calmly explained what he was going to do, and Chevigné, too, became a changed man. Some years later, he saved Pinel's life when a mob attacked the Bicêtre and seized Pinel, accusing him of harboring members of the bourgoisie, turning dangerous lunatics loose, and even poisoning the wells of Paris and causing a cholera epidemic. The crowd was about to hang Pinel when the giant Chevigné burst through to rescue him and rout the mob (Zilboorg & Henry, 1941, p. 324).

In four months time, Pinel ordered the chains removed from fifty-three inmates, and slowly their behavior and the atmosphere at the Bicêtre changed. Pinel always observed his charges with care, for their behavior, he said, is "the physician's best text-book." His reports are rich in case histories. Pinel improved the quality of the inmates' rations and ended all whirling and water "cures," emetics, and bloodletting. Pinel wrote of the latter "the blood of maniacs is sometimes so lavishly spilled, and with so little discernment, as to render it doubtful whether the patient or his physician has the best claim to the appellation of madman" (Pinel, 1801, p. 251). Pinel also used the minimal restraint necessary for safety and order. He believed that "a degree of liberty, sufficient to maintain order, dictated not by weak but enlightened humanity, and calculated to spread a few charms over the unhappy existence of maniacs, contributes in most instances, to diminish the violence of the symptoms, and in some, to remove the complaint altogether" (Pinel, 1801, p. 90).

Pinel's regime had an immediate effect. In 1792, 110 people were admitted to the Bicêtre; of these, 57 died within a year. In 1793, 95 out of 151 died. In the first two years under Pinel's directorship, the proportion of deaths to admissions fell to 1 out of 8. His successes at the Bicêtre Asylum led to his appointment in 1795 as head of La Salpêtrière, the Parisian asylum for insane women. La Salpêtrière, as the name implies, was located on the site of an old gunpowder (saltpeter) factory. The building had been used as an arsenal and then as an asylum for the poor people of Paris. In 1795 it was the largest asylum in Europe, with some eight thousand inmates. Pinel found conditions there as bad as they had been at the Bicêtre, but in addition the guards frequently abused the women inmates sexually. Pinel began to unchain the women of the Salpêtrière just as he had unchained the men at the Bicêtre. He again had many dramatic successes, and his fame spread throughout Europe. Afflicted people from many countries wrote to him for help. Letters addressed only to "Dr. Pinel" were delivered to him. He became a respected member of French medical and intellectual circles. In one of his many public lectures, Pinel outlined his principles of moral treatment:

> First, no cruelty, no humiliation. Use physical force only to prevent the patient harming him or herself or someone else, but not for punishment. Second, get as accurate a case history as possible. Third, encourage work and social relations. Finally, most powerful and unscientific, do your best to understand the patient as an individual human being. (Pinel, in Karon, 1999, p. 2)

Pinel became an effective public speaker and also something of a quiet wit. When the astronomer Joseph Lalande, knowing Pinel's deep religious feelings, twitted him by saying that he was including Pinel in a new edition of his *Dictionary of Atheists*, Pinel replied that he was preparing a new edition of his *Philosophy of Madness* and would be sure to include Lalande in it.

Pinel died of pneumonia in October 1826 in his living quarters at La Salpêtrière. His funeral was a grand state occasion attended by ministers of state, physicians, students, and scientists, but also by hundreds of ordinary people, including some whose attendance surely would have meant the most to Pinel—former inmates of the Bicêtre and the Salpêtrière asylums.

The Wild Boy of Aveyron

One other episode in Pinel's life has proved to be of great interest and importance: the case of the wild boy of Aveyron. Pinel was asked to examine a wild boy, believed to be about 12 years old, who had walked out of the woods of Saint-Serin in the province of Aveyron in southern France on January 9, 1800. From the reports of hunters who had caught glimpses of him, it was believed that he had lived in the woods for some years. He was virtually naked, covered with scars, dirty, and inarticulate. Apparently he had survived on a diet of acorns and roots. He walked on all fours much of the time and grunted like an animal. News of the capture of the wild boy caused a sensation in Paris. The newly formed Society of Observers of Man arranged for him to be brought to the capital for study.

A prevailing view at the time was that civilization had corrupted the pure nature of men and women and that a natural life is the best possible life. Jean-Jacques Rousseau was an active proponent of such views. In 1749, an essay contest was held on the question of whether science or the arts had improved morals more. Rousseau won the contest with an essay arguing passionately against science and claiming that modern scientific society had corrupted and debased the innate goodness and purity of humans. In his books, Rousseau (Morley, 1915) described the natural state of humans as one of harmony and beauty; but this natural state, he claimed, had been corrupted by modern civilization. Such views were further strengthened by reports from European explorers of the seemingly idyllic societies of the South Seas. The wild boy of Aveyron had grown up in nature, so there was great interest in his behavior. Was he indeed a "noble savage"?

The answer was a resounding "No." Taken to Paris in 1800 and exhibited in a cage, the wild boy sat rocking back and forth and was completely apathetic. He was a great disappointment to the hordes of curious spectators and to Rousseau's followers:

> A disgusting dirty child affected with spasmodic movements and often convulsions who swayed back and forth ceaselessly like certain animals in the menagerie, who bit and scratched those who opposed him, who showed no sort of affection for those who attended him and who was in short, indifferent to everything and attentive to nothing. (Itard, 1894, p. 4)

After examining him, Pinel concluded that, far from being a noble savage, the boy was an incurable idiot. Despite this conclusion, one of Pinel's assistants, Jean Marc Gaspard Itard (1775–1838), undertook to care for the wild boy and try to educate him. He gave him a name, Victor, and then made a working assumption that Victor's problems were due to his social isolation rather than the result of brain damage or another organic condition.

Itard undertook Victor's rehabilitation. With the assistance of Madame Guérin, Itard succeeded, after truly heroic efforts, in teaching Victor to pay attention, keep clean and dress himself, eat with his hands, play simple games, obey some commands, and even read and understand simple words. However, despite all their efforts, Victor never learned to talk. At times he showed signs of affection, but often, especially under stress, his behavior was erratic, unpredictable, and violent. Victor learned simple discriminations, but when they were made more difficult, he became destructive, biting and chewing his clothes, the sheets, and even the chair and mantelpiece. After working with Victor for five years, Itard gave up hope of rehabilitating him. Victor's background and the "passions of his adolescence" could not be overcome. Victor lived with Madame Guérin until 1828, when he died at the age of 40, an almost forgotten half-man. Itard told Victor's story in *The Wild Boy of Aveyron;* it was dramatized in François Truffaut's film *The Wild Child,* described in books by Harlan Lane (*The Wild Boy of Aveyron,* 1976) and Roger Shattuck (*The Forbidden Experiment,* 1980), and featured in a *Nova* program called *Secret of the Wild Child* first broadcast in 1994.[2]

Itard considered his work with Victor a failure, but an official report of the French Academy of Science applauded his efforts and pointed out that he had made much progress in helping Victor. Perhaps there was hope for the remedial education of children classified as retarded who came from less deprived backgrounds.

The Remedial Efforts of Johann Guggenbühl (1816–1863)

In 1836, a young Swiss physician, Johann Jacob Guggenbühl, was traveling through the country when he saw a "dwarfed, crippled cretin of stupid appearance" (Kanner, 1964, p. 17) praying at a roadside shrine. At the time, a combination of physical deformity and idiocy was thought to be endemic in certain Alpine valleys. Guggenbühl wondered if such an unhappy state was permanent and resolved to devote the rest of his life to the "cure and prophylaxis of cretinism" (Kanner, 1964, p. 221). On a tract of Alpine land on the Abendberg, near Interlaken, he established a residential and training center for children with mental retardation.

Guggenbühl believed that pure mountain air, the beauty of the Alps, a good natural diet, exercise, and "natural medications"—vitamins, minerals, and salts—would cure cretinism. At first his work was hailed as a major reform, and visitors to Abendberg reported many dramatic cures. Slowly, though, skeptics began to wonder how many children had actually been helped. Rumors of poor conditions and even abuse of the children spread. The British ambassador to Switzerland visited Abendberg to review the treatment of some British children. He found them neglected and the whole institution in a state

[2] Two young girls were found living among wolves in India in 1920. Named Amala and Kamala, they crawled, ran, ate, and scratched like wolves. One of them died shortly after being found. The other never learned to talk and died of an unknown illness at the age of about 17 (Candland, 1993). In 1970, a 13-year-old child who had spent much of her life chained to a potty chair was found in Los Angeles. She did not speak, walk, or respond to others. Efforts to study and help her had mixed and ultimately sad results (Rymer, 1993).

of gross disorder. An official commission of inquiry investigated and concluded that not a single cretin had ever been cured at Abendberg. Guggenbühl went into exile—he had somehow accumulated a large fortune—and died in 1863 at the age of 47. An obituary gave him credit only "for having effectively raised interest in the care of idiots" (Kanner, 1964, p. 29), but he deserves at least a bit more credit, for, as Leo Kanner pointed out:

> Guggenbühl must be acknowledged as the indisputable originator of the idea and practice of the institutional care for feeble-minded individuals. The hundreds of institutions now in existence derive in direct line from the Abendberg. (Kanner, 1964, p. 30)

William Tuke (1732–1822)

For our next reformer we cross the English Channel to consider a Quaker gentleman who at first sight seems a most unlikely agent of change (Sessions & Sessions, 1971). In 1790, William Tuke, a prosperous retired tea, coffee, and cocoa merchant, heard a very disturbing story. Friends told him that when they had tried to visit a Quakeress, Hannah Mills, who had been committed to the Lunatick Asylum in the nearby city of York, the asylum's overseer had not allowed them to enter. This was deeply disturbing, as visiting a fellow Quaker in distress was for them a religious imperative. A few days later, the friends heard that Mills was dead. They suspected foul play and appealed to Tuke for help. Tuke visited the asylum and was horrified by what he saw. He decided to act.

At this time, Tuke was 58 years old. His wife Esther cautioned him, "Thee has had many wonderful children of thy brain,[3] dear William, but this one is surely like to be an idiot" (Sessions & Sessions, 1971, p. 55). With support from the Society of Friends (the Quakers), who preached that God dwells within all people, Tuke devoted the remaining thirty years of his life to supporting an alternative place where "the unhappy might find refuge." In 1796, Tuke established a *Retreat for Persons Afflicted with Disorders of the Mind* near York. The Quakers were unwilling to call their place an *asylum* and had the happy inspiration to use the word *retreat.* They vowed that patients would never be fettered, chained, or manacled, but instead would be given freedom, respect, kindness, good food, recreation, exercise, medical treatment, friendly support, and religious instruction. Tuke's York Retreat was purposely set up to resemble a farm rather than a prison. There were no bars or gratings on the windows, and gardens and farm animals were maintained (Reisman, 1966, p. 13). Patients and staff were always "the family." Tuke lived to be 90 years old and saw his York Retreat succeed and serve as a model for other enlightened institutions for the housing and care of the mentally ill. Both his son and his grandson devoted their lives to the York Retreat (Sessions & Sessions, 1971). It continues to operate to this day.

A Philadelphia Quaker, Thomas Scattergood, visited the York Retreat and was so moved that he "vented a few tears" (Price, 1988, p. 29). Inspired by his

[3] Tuke's "children of the brain" were the two successful Quaker schools he had established and his successful business.

The Connecticut Retreat for the Insane

In December 1820, a prominent Connecticut physician, Dr. Eli Todd (1769–1833), addressed a meeting of the Hartford County Medical Society. His subject was insanity and the difficulty of treating the insane in private dwellings or in prisons. Inspired by the examples of Pinel and Tuke, Todd urged that a retreat be established in Hartford which would not be a hospital, prison, jail, or school but rather a place where the principles of moral management would be used to care for and treat the insane. The medical society established a committee to study the proposal and seek funding. They estimated that there were more than a thousand seriously mentally deranged people in Connecticut needing care and treatment. Committee members also secured personal pledges of $20,000 and a commitment of $5,000 from the State of Connecticut (Braceland, 1972).

In 1822, a formal decision was made to establish the Connecticut Retreat for the Insane. In 1823, a farm and its buildings were purchased, and Todd was appointed as the first superintendent. The Connecticut Retreat for the Insane opened in 1824 with prayers and hymns. Sixty "commodious apartments" were offered at a cost of $3.00 a week to Connecticut residents and $4.00 a week to those from out of state. The first two patients were a man of 36 suffering from "fanaticism" and a young woman of 26 who had "broken down recently from overtaxing the intellect with difficult studies" (Braceland, 1972, p. 19). Todd was an astute clinician who provided one of the earliest accounts of lead poisoning. He believed that the mental faculties of the insane are unbalanced: in mania, excitation dominates; in melancholia, inhibition is dominant. The great design of moral management was to restore the faculties to equilibrium by bringing the remaining sound faculties to bear on those that were out of balance. Self-control was essential. The insane were treated as rational beings to whom treatments and care were explained. They were given liberty and freedom to the maximum degree possible. The insane were trained to live a normal life in harmony with God's natural laws. Early admission was encouraged and the average stay was six months. The number of patients seeking admission to the Retreat increased, as did Todd's reputation. In a remarkable example of support, the Connecticut Legislature in the 1829–1830 session gave permission to the Retreat to conduct a lottery to raise money. Over a period of seven years, that lottery raised a net amount of $40,000 (Braceland, 1972, p. 34).

In November 1833, Todd fell into a coma and died without regaining consciousness. Newspaper and medical journals printed tributes and extolled his principles of moral management. Todd left his entire estate to the Retreat. Institutions modeled on Todd's Retreat were established in Massachusetts, Vermont, and New Jersey. Those institutions provided enlightened and humane treatment for the mentally ill with moral management as their great guiding principle. Today, as the Institute of Living, Todd's Retreat continues to provide care and treatment for both children and adults and to conduct extensive research into mental illness (Braceland, 1972).

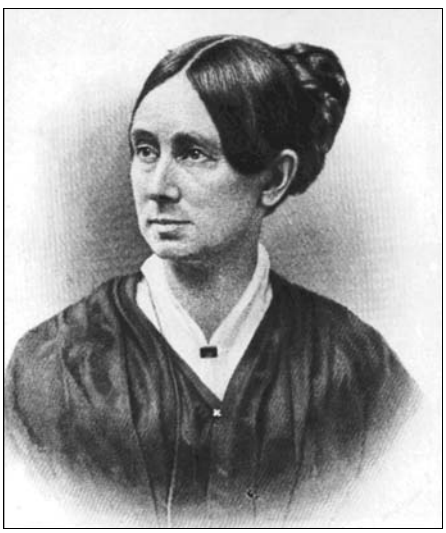
report, the Quakers of Philadelphia in 1813 founded the first private psychiatric hospital in the United States, the Friends Asylum for the Use of Persons Deprived of the Use of Their Reason. The Friends Hospital of Philadelphia is still in operation.

Dorothea Lynde Dix (1802–1887)

Dorothea Lynde Dix was the child of an unhappy home. When she was 10 years old, the religious fanaticism of her father forced her to leave home, and at 14, she began a career in one of the only professions open to her, that of a schoolteacher. Dix also wrote a number of popular books for children and adolescents. When her health failed as a result of tuberculosis, she was forced to give up full-time teaching and to take up an assignment teaching a class of women prisoners at the East Cambridge House of Correction. She was horrified by what she saw. Many people who were clearly mentally ill were treated as common criminals, confined in narrow, cold cells, and not allowed even the minimal privileges of other prisoners. Dix also learned that conditions for the insane were as bad if not worse in other prisons and jails. For the remaining forty years of her life, Dix campaigned for improved conditions for the insane. She traveled to every state east of the Mississippi, and although she was a quiet, dignified, and proper lady, her tactics were overwhelming. Dix became, in the title of a recent biography, an effective *Voice for the Mad* (Gollaher, 1995). First she would obtain facts about conditions in a particular state, and then she would shrewdly and effectively publicize the abuses and mistreatments she had found. She would enlist public support and that of key legislators. Starting with Massachusetts and then Rhode Island, Dix presented memorials describing the atrocious conditions she had seen. Between 1845 and 1852, Dix testified before the legislatures in at least a dozen states (Lightner, 1999). In a *Memorial to the United States Congress,* Dix described how she had seen

> more than nine thousand idiots, epileptics, and insane in the United States, destitute of appropriate care and protection . . . bound with galling chains,

Dorothea Lynde Dix.
(The Bettmann Archive)



> bowed beneath fetters and heavy iron balls attached to drag-chains, lacerated with ropes, scourged with rods and terrified beneath storms of execration and cruel blows; now subject to jibes and scorn and torturing tricks; now abandoned to the most outrageous violations. (Dix, quoted by Sargent & Stafford, 1965, p. 276)

Dix campaigned in Washington to secure a land grant bill for the benefit of the insane. States would receive federal land they could sell to establish mental hospitals, just as they had done to establish land grant state universities under the Morrill Act of 1862. The bill Dix supported passed both Houses of Congress only to be vetoed by President Franklin Pierce.

Always Dix preached her gospel of humane treatment and adequate facilities for the insane and retarded. Within three years she visited eighteen states and stimulated reforms in most of them. Old hospitals were modernized and new ones built. In all, forty mental hospitals in the United States and Europe owe their establishment to Dix. She thought of the inmates as her children, visiting and often staying with them. During the Civil War, Dix served as the chief of hospital nurses, emulating Florence Nightingale. After the war was over, she visited Europe on a lecture tour. In an audience with Queen Victoria, the indomitable Miss Dix lectured the queen on the need for continued reforms in England. This may have been the only time during her reign that Queen Victoria received a lecture. The experience made such an impression that she appointed a royal commission to investigate British insane asylums. In an audience with Pope Pius IX, Dix described Rome's insane asylums as a scandal and disgrace, prompting the Pope to promise the establishment of a new asylum in Rome (Reisman, 1966). Towards the end of her life, Dix wrote that the huge, wild beast of reform had consumed her life (Brown, 1998). Dix spent the last year of her life as an honored guest at the Trenton State Hospital, where she died in 1887. In 1983, the United States Postal Service issued a Dorothea Dix commemorative stamp as part of the Great American series.

State Institutions for the Insane and the Retarded in the United States

In 1770, the Virginia House of Burgesses, responding to a request from the British Governor, enacted a law providing for the support and maintenance of idiots, lunatics, and other persons of unsound mind. The result was the first public institution in the United States devoted exclusively to the care and treatment of the insane, which opened in Williamsburg, Virginia, in October 1773 (Zwelling, 1985). This facility was part prison and part infirmary. Windows were barred, doors were bolted, and the inmates were restrained with leg irons and straitjackets. The institution's first *keeper,* James Gault, had formerly headed the Public Gaol in Williamsburg. This asylum closed in 1885 and has been restored as a museum open to the public (Turkington, 1985).

The early and middle decades of the nineteenth century saw the establishment of many large state-run asylums and institutions in the United States. At first they were modeled on private institutions such as the Friends Hospital of Philadelphia and the Connecticut Retreat. Often located in rural settings, their

McLean Hospital's Mad Poets Society[4]

McLean Hospital is one mental hospital in the United States that comes close to Dix's vision. It was founded in 1811 in Charlestown, Massachusetts as the psychiatric department of the Massachusetts General Hospital. The hospital's move to Belmont, ten miles west of Boston, in 1895 allowed an implementation of Dix's vision. The hospital was built on a beautiful 240-acre campus selected by America's foremost landscape architect, Frederick Law Olmstead. With its bucolic campus, humane philosophy, and innovative treatments, McLean attracted upper-class Bostonians, artists, and writers. Its patients were "thoroughbred crazies, the gracefully insane" (Beam, 2001b). Robert Lowell, one of America's most distinguished poets, was institutionalized in 1958 when he was unable to control his manic behavior. His moving poem *Waking in the Blue* describes his life among the "screwballs" at McLean.

("This is the house for the "mentally ill.")
I grin at Stanley, now sunk in his sixties,
once a Harvard all-American fullback,
(if such were possible!)
still hoarding the build of a boy in his
    twenties,
as he soaks, a ramrod
with the muscle of a seal
in his long tub,
vaguely urinous from the Victorian
    plumbing.
A kingly granite profile in a crimson golf-cap,
worn all day, all night,
he thinks only of his figure,
of slimming on sherbert and ginger ale—
more cut off from words than a seal.

This is the way day breaks in Bowditch Hall
    at McLean's;
the hooded lights bring out "Bobbie,"
Porcellian '29,
a replica of Louis XVI
without the wig—
redolent and roly-poly as a sperm whale,
as he swashbuckles about in his birthday suit
and horses at chairs.

These victorious figures of bravado ossified
    young.

Poet Sylvia Plath was admitted to McLean with suicidal depression during her senior year at Smith College. Her book *The Bell Jar* (1971) was based on her experience there. This curious "McLean chic" culminated in the Oscar-winning film version of Susanna Kaysen's memoir *Girl, Interrupted* (Beam, 2001b, p. 97). Admitted at the age of 18, Kaysen spent two years at McLean. Anne Sexton was another of McLean's Mad Poets. Sexton was intrigued by mental illness. Her first poetry collection was titled *To Bedlam and Part Way Back.* Sexton taught a seminar on poetry at McLean in 1969 and was admitted as a patient in 1973. Poems in her last collection, *The Awful Rowing Toward God,* reflect her struggle with depression and self-doubt. Sexton committed suicide in 1974.

Today McLean is the largest psychiatric teaching facility of Harvard Medical School, with treatment programs for a wide range of mental illnesses. It continues to attract celebrity patients, including the mathematician John Forbes Nash, Jr., the winner of the 1994 Nobel Prize in economics and the subject of the film *A Beautiful Mind;* jazz great Ray Charles; and singer James Taylor (Brubach, 2002, p. 8). McLean maintains the world's largest research program on mental illness in a private hospital, but in the contemporary era of managed care in the 1990s, the facility lost millions of dollars a year.

[4] This material is derived from: Beam, A. (2001). "The Mad Poets Society." *The Atlantic Monthly,* July-August, 2001, vol. 288, 95–103; and Beam, A. (2001). *Gracefully insane: The rise and fall of America's premier mental hospital.* New York: Public Affaires.

goal was to provide the insane from all social classes with moral treatment and education. Some well-run institutions achieved cure rates of 50 percent (Dain, 1971), but sadly, within months of opening, these institutions were inundated with great numbers of chronically disturbed people, many of whom had resided for years in almshouses, poorhouses, jails, and prisons. "Moral treatment" was not effective with these people, many of whom were chronically mentally disturbed. In addition, disproportionately large numbers of immigrants were committed, and the staff members were totally unprepared to deal with their different ethnic and cultural backgrounds. The states then established large, state-run custodial institutions. With the economic difficulties following the Civil War, funding for these public institutions was uncertain; the physical facilities deteriorated and standards of care fell. Williams, Bellis, and Wellington reviewed those years a century later:

> Increasingly, the major task of the asylum staff became the control of what was seen as deviant and dangerous behavior. The humane authoritarianism of moral treatment was transformed into rigid authoritarian control of people of whom little was understood or expected. Within a few years of their founding, the public asylums had become repositories for the custodial care of the poor and immigrant classes. (Williams et al., 1980, p. 57)

Early in the twentieth century, Clifford W. Beers founded the mental hygiene movement. In 1901, Beers had been committed to the Hartford Retreat in a delusional and suicidal state. After years of struggle, he recovered, and in 1906 wrote a book, *A Mind That Found Itself,* describing his experience. Beers enlisted the support of many influential people, including Theodore Roosevelt and America's leading psychologist, William James (Chapter 11). He was able to cite his own case to counter the pessimism that so often surrounded mental illness and the mentally ill. His efforts led to the establishment of the National Commission for Mental Hygiene in 1909.[5] Despite such efforts, the care and treatment of the mentally ill went into a decline. The Great Depression and World War II diminished both the number of staff members and the financial support for mental institutions. In 1949, Albert Deutsch surveyed over two dozen state mental hospitals and found

> scenes that rivaled the horrors of the Nazi concentration camps—hundreds of naked mental patients herded into huge, barnlike, filth-infested wards, in all degrees of deterioration, untended and untreated, stripped of every vestige of human decency, many in stages of semistarvation. (Deutsch, 1949, p. 449)

In 1949, no state mental hospital met the minimal standards of operation set by the American Psychiatric Association (Williams et al., 1980, p. 61). While there has been progress since then, highlighted by the 1949 creation of the National Institute of Mental Health (NIMH) and the Community Mental Health Center Act of 1963, a visit to many contemporary institutions for the mentally ill and retarded shows that progress has been slow and much still needs to be

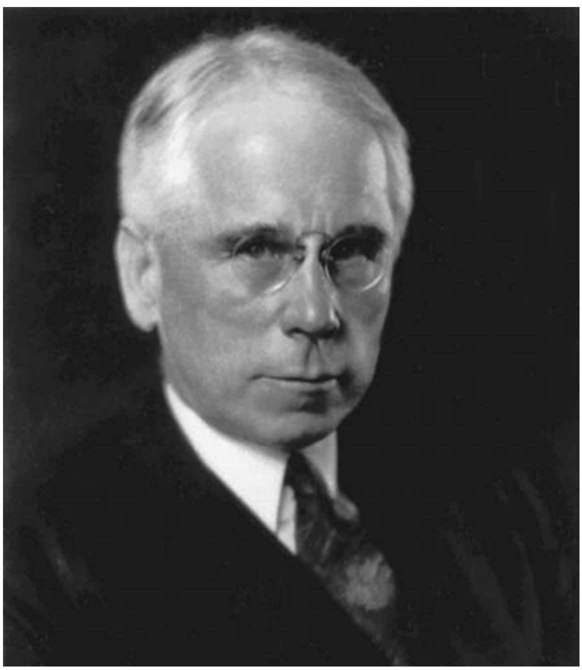
[5] The Committee's successor, the National Mental Health Association (NMHA), is America's oldest and largest nonprofit organization addressing all aspects of mental illness and mental health. The Clifford W. Beers Award given each year is the organization's highest honor.

done. A report described the Dorothea Dix Hospital in Raleigh, North Carolina, as a dangerous place where "wolves and lambs create a volatile mix, escalating violence includes beating and rape, and patients are crowded five to a room" (Overton, 1986). Deinstitutionalization policies in the 1970s led to the release of many former patients. All too often they were left without adequate supervision and support and simply swelled the numbers of the urban homeless (Johnson, 1990; Isaac & Armat, 1990). In California during the 1980s, the number of mental hospital beds decreased from forty thousand to five thousand. In a poignant book, seventy authors vividly described in poetry, prose, and drawings their lives in mental hospitals and on the streets after release: they depicted a world of forced medications, sexual abuse, uncaring staff, and electroconvulsive therapy (ECT); being on the streets and feeling like invisible nonpersons; searching for food, shelter, and legal representation; and enduring through endless time (Susko, 1991).

The Establishment of Clinical Psychology

Lightner Witmer (1867–1956) founded the first psychological clinic in the United States at the University of Pennsylvania in March 1896 (McReynolds, 1987; Benjamin, 1996). Witmer took his degree with Wilhelm Wundt and, like Titchener and Münsterberg (Chapter 5), came to the United States in 1892. In

Lightner Witmer, the founder of clinical psychology in the United States.
(Archives of the History of American Psychology)



Witmer's case he was returning to the United States and to the University of Pennsylvania, where he had been a student and research assistant under James McKeen Cattell. When Cattell left Pennsylvania for Columbia, Witmer took over his laboratory of experimental psychology.

Though trained as an experimental psychologist, Witmer believed that psychology must help people. In particular he saw a need for an area of psychology, apart from psychiatry, devoted to the care and treatment of the mentally ill. Psychiatrists and even some psychologists opposed his position, including Münsterberg (Chapter 5), who dismissed Witmer's efforts and insisted that therapy remain within the province of medicine (McReynolds, 1997b). In 1896, a 14-year-old boy with a peculiar spelling problem was referred to Witmer by his teacher. Witmer's treatment of that boy, known by the pseudonym Charles Gilman, marks the formal beginning of clinical psychology. Witmer (1907) reported that Gilman was of above-average intelligence, and reasoned and spoke well. But his reading and spelling were deficient: he would read the word *was* as *saw* and had difficulty reading words of more than two letters. Witmer termed Gilman's problem *visual verbal amnesia,* as he was unable to fix the forms of words in his memory. Both Witmer and Gilman's teacher provided intensive remedial work in which Gilman was trained to recognize words without first having to spell them out. Their efforts showed some success, although the boy never learned to read in a normal manner. Gilman's formal treatment ended in April 1897, and he died of tuberculosis in 1907.

Witmer saw other children with severe speech defects or developmental delays. He used direct training techniques and advice to try to help them. In 1907, Witmer formally proposed a new helping profession, clinical psychology, independent of both medicine and education (Witmer, 1907). He founded the journal *Psychological Clinic* so that descriptions of clinical cases could be published. Witmer edited that journal for many years, and it provided an important vehicle that allowed psychologists to report on clinical cases. In 1908, Witmer established a residential school for the treatment of retarded and troubled children. In the 1920s, one of his students, Morris Viteles, began work in the field of vocational guidance. In 1921, the Witmer School for Troubled Children was established to provide comprehensive services for children in need.

Witmer also made an unexpected contribution to comparative psychology (Burghardt, 1989). In 1909 and 1910, he published two papers in his journal *Clinical Psychology,* describing his observations of a "monkey with a mind" and "intelligent imitation and curiosity in a monkey." The "monkey" was actually a performing chimpanzee named Peter. Witmer tested Peter in his clinic and was fascinated by how humanized he was. When Peter entered the clinic, he shook hands with Witmer's secretary and kissed the back of her hand! He accepted a cigarette, struck a match, and lit the cigarette. Peter locked and unlocked a padlock and quickly learned to remove a staple. With a hammer he drove several nails into a board; when given a screw instead of a nail, Peter put the hammer aside and used a screwdriver. When asked "Where is Peter?" he pointed to himself. Peter's performance was remarkable. Witmer's descriptions of his behavior were antecedents of later descriptions of language-using and problem-solving apes (Parker & Gibson, 1990).

Radical Physical and Pharmacological Treatments of Insanity

Because of the overcrowded and atrocious conditions in institutions for the insane, "great and desperate cures" that promised successful treatment of insanity were enthusiastically received (Valenstein, 1986). The most desperate of these cures was psychosurgery. In December 1935, Egas Moniz (1874–1955), a Portuguese neurologist trained at La Salpêtrière, drilled holes into the skull of a mental patient and used a specially constructed instrument to cut or crush the nerve fibers in its path. He developed this procedure after observing an apparent calming effect in a lobotomized chimpanzee (P. Pinel, 1990, p. 20). Moniz labeled his procedure *prefrontal leucotomy,* since its target was the brain's frontal lobe and a *tome* (Greek for "knife") was used to cut or crush the nerve fibers. Four months later, Moniz presented the results from twenty such operations. Seven patients were considered recovered, seven were improved, and six were unchanged (Valenstein, 1986, chapter 6). In January 1937, Moniz reported successful outcomes in eighteen additional patients. Moniz's reports of success were often exaggerated; he ignored side effects, and he based his reports on vague and subjective data. Nevertheless, his procedures were widely used. For his work, Moniz shared the 1949 Nobel Prize for medicine. In an ironic and tragic postscript, Moniz was shot by one of his lobotomized patients and rendered paraplegic by a bullet that lodged in his spine.

Three men were responsible for introducing *lobotomies* on a wide scale. John Fulton, the chair of Yale University's department of psychiatry, was eager to demonstrate a close relationship between laboratory investigations and clinical interventions in mental illness. Fulton believed lobotomy to be based on sound laboratory investigation and advocated its use (Pressman, 1998). Walter Freeman (1895–1927), an American neuropathologist and neuropsychiatrist, and his colleague James Watts (1904–1994) were largely responsible for the worldwide adoption of psychosurgery as a treatment for mental illness. In 1936, at the George Washington University Hospital in Washington, D.C., Freeman and Watts performed the first frontal lobotomy[6] in the United States. By 1950 they had performed one thousand lobotomies, and a decade later surgeons in the United States had performed an estimated fifty thousand (Hilchey, 1994, p. A15). Freeman wrote that lobotomies would "make good American citizens of society's misfits, schizophrenics, homosexuals, and radicals" (Freeman, quoted by Talbot, 1991, p. 4). In 1941, Rosemary Kennedy, the sister of a future President of the United States and of two United States Senators, underwent a prefrontal lobotomy at St. Elizabeth's Hospital in Washington, D.C. The operation ended her wild mood swings but so altered her personality that all but the most minimal connection with her family ended. She functioned at a childlike level and was confined to a convent in Wisconsin. Fearing damage to the political aspirations of his sons, Joseph Kennedy told the press that she had chosen to devote her life to a religious order and

[6] Their technique involved drilling holes in the skull, inserting and rotating a knife to sever links between the prefrontal lobes and the rest of the brain.

was working with retarded children (Collier & Horowitz, 1984, p. 116).[7] Between 1948 and 1952, neurosurgeons in the United States performed five thousand prefrontal leucotomies a year. Ultimately, controlled long-term studies of the outcomes of such operations contraindicated their use. Moniz, Fulton, and Freeman had grossly exaggerated the beneficial effects and minimized such devastating side effects as lack of emotion, retarded movements and inertia, loss of initiative, mutism, and negativism. At an International Mental Health Conference in Vienna in 1953, lobotomy was described as "turning a human being into a vegetable," as making "idiots out of madmen," and as an act of "therapeutic nihilism" (Oserezski, in Gerow, 1988, p. 38). In 1970 the number of psychosurgical procedures done in the United States was about three hundred. In these operations, stereotaxic instruments (Chapter 3) were used to direct electrodes to brain targets. Before such procedures were developed, tens of thousands of people all over the world had been lobotomized, often with devastating results.

Other physical treatments for mental illness included spas, rest cures, thermal therapies and pine-needle baths (Sharter, 1997, p. 137). More radical treatments involved the induction of coma or convulsions of the brain. With little theoretical justification or evidence from animal research, such cerebral insults were expected to produce beneficial effects. Manfred Joshua Sakel, a Viennese physician, claimed in 1933 that 88 percent of the schizophrenics he had treated improved after recovering from a deep insulin-induced coma. Joseph Ladislau von Meduna introduced shock therapy using pentylenetetrazole (Metrazole) to induce a convulsion in 1935. Meduna's rationale was that since people with epilepsy rarely suffer from schizophrenia, a massive convulsive seizure might be effective in treating schizophrenia. This method was widely used in the United States to treat schizophrenia. Convulsive treatment using electric shock (electroconvulsive therapy, or ECT) was developed by two Italians, Ugo Cerletti and Lucio Bini. They first used the technique in 1938 with schizophrenic patients, but later found it to be most valuable in treating depression. By 1941, ECT was in use in 43 percent of mental institutions in the United States.

Of these convulsive treatments, only electroconvulsive therapy (ECT) continues to be used with any frequency today. The theoretical justification for convulsive treatments was never convincing, and there is always a distinct possibility of causing permanent brain damage with such treatments. ECT has been found effective for a sizable number of depressive patients who do not respond to other therapies such as antidepressant drugs (Cole & Davis, 1975). One way to decrease the possibility of brain damage is to limit the convulsion to one cerebral hemisphere, typically the nondominant side of the brain, and to restrict the number of treatments.

The second class of radical treatments involves the use of drugs having psychological effects. In the middle decades of the twentieth century, psychoactive drugs were developed that provided not a cure but relief for some forms

[7] Later the Kennedy family, and especially Eunice Shriver Kennedy through the Kennedy Foundation and the Special Olympics, did much to improve the care and treatment of persons with mental illness (Wills, 1981, p. 128).

of mental illness. In the 1950s, chlorpromazine was widely used in Europe and the United States to treat schizophrenics, many of whom were able to return to work and lead almost normal lives in the community. But the drugs also had problems. Required doses of chlorpromazine varied greatly from patient to patient; at high doses patients developed rigidity, difficulty moving, and tremors. Arvid Carlsson, a Swedish pharmacologist, discovered dopamine to be present in high concentration in the *corpus striatum*, a part of the brain that regulates movement. Dopamine is depleted in patients with Parkinson's Disease, and L-dopa, a chemical converted to dopamine in the brain, is a principal treatment for Parkinson's. Carlsson studied how antischizophrenic drugs like chlorpromazine work. His hypothesis suggested that such drugs block dopamine receptors in the brain. Phenothiazines, drugs that block synaptic receptors in the brain that are sensitive to dopamine, have been reported to reduce the symptoms of schizophrenia (Snyder, 1984). Arvid Carlsson shared the Nobel Prize for medicine in 2000.[8]

Researchers have known that lithium is useful in treating depression since the mid-1960s. But since lithium is a common salt that cannot be patented, major pharmaceutical companies were unwilling to invest in clinical trials, and its widespread use was delayed (Snyder, 1984, p. 142). Paradoxically, lithium has been found to be effective in treating both the mania and the depression that characterize bipolar affective disorders. Finally, a class of drugs known as antidepressants has been widely used for decades. These psychoactive drugs have had an enormous impact. In 1955, there were 560,000 patients in mental hospitals in the United States, with over half diagnosed as schizophrenics; by 1970, the number of patients had declined to 340,000, and by 1984, to less than 150,000 (Rothman & Rothman, 1984).

Mesmerism and Hypnosis

Mesmerism[9] and later hypnosis were used widely to treat a variety of physical and mental illnesses during the eighteenth and nineteenth centuries. The interest of French scientists and physicians in hypnosis dates back to the work of Franz Anton Mesmer (1734–1815). Mesmer qualified as a physician at the prestigious Medical School of Vienna. He was a man of high social class, a well-known physician, and a friend of artists and musicians, including Leopold Mozart and his son, Wolfgang Amadeus Mozart. Mesmer's medical dissertation was on *The Influence of the Planets on the Body* (1766). He believed that planets generate celestial forces that can be focused through magnets to affect the human body, just as the moon affects the oceans through the tides. He lived at a time when magnetism and electricity were mysterious forces recently intro-

[8] The two other recipients were Eric Kandel for research on the neurochemical basis of memory and Paul Greengard for his analysis of the series of steps inside a neuron after dopamine stimulates the cell's dopamine receptors.
[9] *The Devil's Dictionary* defines *mesmerism* as "Hypnotism before it wore good clothes, kept a carriage, and asked Incredulity to dinner" (Bierce, 1958, p. 87).

duced to scientific thought (Chapter 3). Mesmer found that his patients would sometimes fall into a trance when he used a magnet to make stroking passes over their bodies. He also reported magnetic cures of sickness and disease and went so far as to claim in 1766 that in this magnetic method, "the art of healing reaches its final perfection." His medical colleagues, however, rejected his claims, and in 1777, Mesmer was expelled from the medical faculty of the University of Vienna and ordered to cease the practice of medicine. He found exile in Paris, a city which

> seemed to attract and nourish an assortment of confidence men, fakers, and adventurers rarely equaled in history. The success of science had produced a fertile ground for almost any idea in Paris (perhaps augmented by pre-Revolutionary restlessness) and the resulting picture was a kaleidoscope of popular science, buffoonery, and outright charlatanism. (Hoffeld, 1980, p. 378)

Mesmer established a fabulously ornate clinic on one of the most fashionable streets in Paris. His reputation spread, and day after day large crowds gathered. They waited in a dimly lit room as Mesmer's associate, Charles D'Eslon, himself a prominent physician to the royal family, removed a wooden cover from a large oaken tub, the *baquet,* and added water and chemicals to cover a layer of iron filings. The cover was then replaced, and jointed iron rods inserted through openings in the tub's sides. Then the "great healer" would make his entrance. Sometimes dressed as a magician, Mesmer would walk in silence around the room, touching each person in turn with a long iron wand. Often when he stared into a person's eyes and gave the command "*Dormez*" (sleep), the person would fall into a trance. He or she had been *mesmerized.* Thousands of people flocked to the clinic. Mesmer's popularity was immense, but he was not without critics. The French clergy swore that Mesmer had sold his soul to the devil, while the medical profession described him as an impostor, charlatan, and quack. Unintimidated, Mesmer challenged the French Academy of Medicine to choose twenty patients, assign ten to him for treatment and ten to members of the Academy, and compare the outcomes. The academy rejected the challenge.

In 1781, at the urging of Queen Marie Antoinette, who was one of Mesmer's most ardent supporters, the French government offered him a chateau and a lifetime pension if he would reveal his methods. Mesmer refused. In 1784, the French Academy of Science appointed a royal commission to investigate Mesmer and his claims. The commission included the American ambassador, Benjamin Franklin, who was well-known for his demonstrations of natural electricity; Antoine Lavoisier, the discoverer of oxygen; Joseph Guillotin, whose invention was soon to be used widely and who was executed with his own invention in May 1784; and the astronomer Jean Bailly. Commission members devised sophisticated tests of Mesmer's claims (Gould, 1989): they told some subjects that nonmagnetized objects were magnetized and others that they were being magnetized when they were not. Mesmer claimed that nickel had special powers. The commission tested a disc he used and found that it was not nickel, but lead (Tatar, 1978). Commission members found no results when they themselves were mesmerized; Franklin reported only boredom (Gallo & Finger, 2000, p. 340).

In its August 1784 report, the commission condemned the practice of mesmerism as dangerous and useless and branded Mesmer a mystic and fanatic. In addition to the public report, the commission wrote a secret report for the king. This report contained sexual information; the commission had discovered that Mesmer often treated young, attractive women who were not really ill but went to him out of idleness and a desire to be amused. Under the magnet's influence, these women were said to be unaware of what was happening and unable to control themselves. Undaunted by the commission's findings, Mesmer continued to practice, and his notoriety grew. However, the succeeding years brought hardship. In 1786, D'Eslon died while in a trance; a popular play, *The Modern Doctors,* performed in Paris, satirized Mesmer with frequent sexual innuendos. In 1792, Mesmer was forced to leave Paris, going first to London and then to Germany. Several years before his death in 1815 he moved back to Paris, but by that time the passions surrounding mesmerism had cooled, and he spent his final years practicing medicine and animal magnetism in Meersburg, Germany, on the shores of Lake Constance (Gravitz, 1990).

Mesmerism in England

John Elliotson was Mesmer's foremost follower in England. He was an established member of the English medical profession, a past president of the Royal Medical and Surgical Society of London, and a professor of medicine at University College in London, a college he had helped found. Elliotson was also something of a radical. He introduced many new drugs to medical practice and was the first person in England to use a stethoscope, an instrument invented in 1816 by French physician René Laennec (Reiser, 1979). Elliotson's interest in mesmerism was aroused when he saw demonstrations of induced trances and apparent cures of various illnesses. He became an advocate of mesmerism, giving demonstrations and even performing surgery on mesmerized patients. His colleagues were scandalized. In 1837, the council of University College passed a resolution forbidding the practice of mesmerism in the hospital. Elliotson resigned and never entered the college again.

Elliotson and other mesmerists apparently did have some successes. Their most spectacular and well-publicized cure was the case of Harriet Martineau, an ardent feminist who believed she was dying of cancer. She was mesmerized with such striking results that the next day she was able to walk fifteen miles and write fifteen pages of text without any fatigue. She described her case in an article in the *Athenaeum* of November 1844, but Elliotson's critics greeted even this dramatic case with scorn. They branded Martineau a hysterical woman and dismissed the claim that she was cured of cancer (Bailey, 1981).

James Esdaile (1808–1859), a surgeon with the British East India Company in Calcutta, India, read a description of Elliotson's use of mesmerism in surgery and began to use the procedure in his operations. To his surprise and pleasure, he found that his patients not only survived such operations but also reported that they had not experienced pain. By 1846, he had used mesmerism successfully in more than three thousand operations (Esdaile, 1846; Gravitz, 1988). During the operations, Esdaile's patients lay relaxed and quiet. They were less frightened than conventional surgical patients, and many Indians came to Esdaile instead of going to traditional surgeons. However, his medical colleagues remained critical, and Esdaile had difficulty publishing descriptions of his work.

Esdaile's was not the only successful use of mesmerism in surgery. In 1829, a French physician, Jules Cloquet, described the successful removal of a diseased breast (mastectomy) in a 69-year-old mesmerized patient. In 1842, an English surgeon named James Ward amputated a patient's leg under a mesmeric trance. However, interest in mesmerism as an anesthetic procedure quickly diminished with the development of chemical agents. In 1844, an American dentist named Horace Wells had one of his own teeth extracted while under the influence of nitrous oxide; in 1846, ether was first used as a general anesthetic in an operation at the Massachusetts General Hospital. The operation was a success, and Henry Bigelow, one of the surgeons who observed it, announced afterward, "I have seen something today that will go around the world" (Cohen & Dripps, 1970, p. 44). In 1847, chloroform was used to reduce the pain of childbirth. Somehow these chemical anesthetic agents seemed more acceptable than the mysterious mesmerism, but in recent years hypnosis has again been used as an anesthetic procedure, especially for dental surgery.

Hypnosis in England and France

The term *hypnosis* is generally credited to the English physician and surgeon James Braid (1795–1860), who used it in 1843.[10] Two years earlier, in November 1841, Braid, a practicing physician in Manchester, England, had attended a demonstration by an itinerant Swiss mesmerist named Charles La Fontaine. Braid was highly skeptical of the mesmerist's claims, but he did notice that the mesmerized subject's eyelids became heavy, drooped, and then closed. At home he tried to mesmerize his wife and a friend. They stared at a slowly moving, bright metallic object while Braid suggested that their eyelids were becoming heavy. They both closed their eyes and fell into a trance. With this experiment, Braid ended the long, acrimonious debate over the role of magnetism and demonstrated the importance of fixation and suggestion in inducing a trance. Braid concluded that hypnosis is a form of sleep induced by suggestion and a narrowing of attention. In 1843, he described numerous cases in which hypnotism had relieved illness and suffering. Braid, however, was always an empirical observer. His goal was scientific description and understanding, not advocacy of Mesmer and Elliotson.

Mesmer's two most immediate successors in France were Ambrose-Auguste Liébault (1823–1904) and Hippolyte Bernheim (1837–1919; Chapter 11). In 1864, Liébault began practicing as a hypnotist in Nancy. He claimed

[10] Earlier in 1821, Frenchman Etienne Felix d'Henin de Cuvillers first applied the *hypn-* prefix to a number of words describing the mesmeric process: *hypnotique*, *hypnotisme* and *hypnotiste* (Gravitz & Gerton, 1984, p. 109).

a number of cures of physical illness and convinced the initially skeptical Bernheim of the value of the procedure. With the assistance of a chemist, Emil Coué, he combined hypnosis with drugs, and Nancy became an important center for the treatment of psychosomatic illness. A second French hypnosis clinic was opened by Jean-Martin Charcot (1825–1893) in Paris. It was to Charcot's clinic that a young Viennese physician traveled in 1885, hoping to learn how to use hypnosis in treating hysterical patients. The young man's name was Sigmund Freud, and his theories and treatments were to change forever our conception of the human condition.

SIGMUND FREUD (1856–1939)

Freud's Early Life

Sigmund Freud was born in Freiberg, Moravia, on May 6, 1856, the first child of Jacob Freud's third wife. At the time, Freiberg was part of the Austrian Empire; today it is part of the Czech Republic. Freud was raised in the traditions and beliefs of the Jewish religion; his great-grandfather had been a rabbi. Though he later described his attitude to religion as "critically negative," Freud always considered himself a Jew. His family traced its heritage back to the fourteenth century and had originally fled from Cologne to escape anti-Semitic persecution. Freud's father was a wool merchant, a hardworking but often impoverished man. In 1859, when Freud was 3 years old, his family moved to Vienna. Since the Austrian Jews had only been emancipated in 1848, there was still much anti-Semitism, and their early years there were difficult financially. Freud did well at school, graduated from high school *summa cum laude,* and was rewarded by his father with a trip to England, as the family's finances had improved. Freud had always been a serious student with a deep need for recognition from his father and other authority figures. He loved literature—Shakespeare was his favorite author—and was proficient in German, French, English, Italian, Spanish, Hebrew, Latin, and Greek (Jones, 1953).

Freud's Education

As a child, Freud dreamed of being a great general like his boyhood heroes, Hannibal and Napoleon, or a minister of state like another of his heroes, Oliver Cromwell. When the time came for him to prepare for a profession, however, his dreams were wrecked by the harsh realities of anti-Semitism. In late nineteenth-century Vienna, a Jewish boy's choices were restricted. Freud considered a career in law but found legal affairs dull, and so, though he later admitted to "no particular predilection for the career of a physician" (Freud, 1935, p. 13), he chose a medical career, entering the University of Vienna in 1873. Freud's favorite faculty member was Franz Brentano (Chapter 6), a man Freud described as "a dammed clever fellow." As Freud took five of his courses, the Catholic Brentano led Freud to a serious consideration of theism and a belief in God. But the flirtation was brief, and Freud maintained his position as an uncompromising atheist; a self-described "godless Jew" (Gay, 1989, p. 685). Freud did not graduate until 1881. Given his drive and dedication, it is surprising that he took three years longer than the average medical student to obtain his degree. The delay was caused by a year's military service in 1879, time spent translating and editing a German edition of John Stuart Mill's works (Chapter 2), and the biological research Freud did under Vienna's professor of physiology, Ernst Brücke. Freud did important research on the gonadal structure of eels and the nerve cells of crayfish and developed an important gold chloride method for staining nerve cells. In all, he spent six productive years at Brücke's research institute. Freud left reluctantly when it became clear that he would not be appointed to one of the institute's two research assistantships, both of which were held by young men.

Freud spent the next three years working his way through the various departments of the Vienna General Hospital, including spending five months in the psychiatric clinic of Theodor Meynert (1833–1892). Meynert had a great influence on Freud, who regarded Meynert as the most brilliant man he had ever met. In Meynert's clinic Freud saw his first hysterical patients. This experience was important, but even more critical in developing Freud's interest in hysteria was a case his colleague Josef Breuer had seen (1859–1936).

Josef Breuer and the Case of Anna O.

Breuer was the son of an emancipated rabbi known as a liberal and progressive teacher of religion (Hirschmüller, 1989). He was a distinguished neurologist who, as a young medical researcher, had established that the vagus nerve controls breathing and the semicircular canals affect equilibrium. He established a successful medical practice in Vienna. Breuer's patients included the family of Franz Brentano and the composer Johannes Brahms. In late nineteenth-century Vienna, Josef Breuer was known as the "doctor with the golden touch" because of his successful treatment of hysteria. Freud described Breuer as "a man of striking intelligence and fourteen years older than myself. Our relations soon became more intimate and he became my friend and helper in many circumstances" (Freud, quoted by Eissler, 1978, p. 13).

From November 1880 to the summer of 1882, Breuer treated Bertha Pappenheim. Pappenheim was born into a wealthy, Viennese, orthodox Jewish family on February 27, 1859. Her education included religious training and ten years of formal training in a private Catholic school. An accomplished linguist, Pappenheim was proficient in Hebrew, Yiddish, English, French, Italian, and German. Yet her education ended at the age of 16 as there were no further educational opportunities open to her in Vienna at that time. From the summer of 1880, she nursed her father during his terminal illness. That autumn, Pappenheim developed a severe and persistent cough followed by other disabling symptoms including:

> Paralysis of her right side, upper left side, and neck; visual problems; temporary deafness; and considerable linguistic disturbances, including mutism, incomprehensible speech, and the loss of her ability to speak or understand German. She alternated between a waking state in which she was melancholy and anxious but normal and an alternate state of consciousness—which she called "time missing"—in which she hallucinated, misbehaved, threw

> cushions, and accused people of doing things to her and leaving her in a muddle. (Kimball, 2000, p. 21)

Breuer, the family doctor, could find no physical basis for her symptoms. But he did take them seriously and listened to her complaints. Pappenheim's condition worsened, and after the death of her father in April 1881, she received treatment including sedatives and morphine in a sanatorium.

Breuer treated Pappenheim for the next eighteen months. She was attractive, intelligent and articulate. Breuer was fascinated and saw her once and sometimes twice a day, often for extended visits of several hours. Pappenheim led Breuer to attempt to trace the first appearance of her symptoms. Paralysis of her arm had first appeared when she "saw" a large, black snake in her father's bed. She tried to push the snake away but could not move her arm. Her deafness first appeared when she heard music from a dance she wanted to attend but could not go to because of her nursing duties. Mutism first appeared when she had decided to tell her father the nursing was too demanding, but then was unable to do so. Recalling these episodes was intensely emotional for her. Breuer labeled release of the emotional tension *catharsis,* a term Aristotle had first used (Chapter 1). After catharis, Pappenheim felt calm and cheerful. She described talking about her symptoms as "chimney sweeping"; Breuer labeled it the "talking cure" (Clark, 1980, p. 102).

Breuer's wife was unhappy that he was spending so much time with this attractive young woman. She insisted that he terminate Pappenheim's treatment. So in the spring of 1882, Breuer and Pappenheim mutually agreed to end their professional relationship. Different historical accounts describe their reactions. Jones, Freud's official biographer, reports that Breuer was recalled on the day treatment ended to find Pappenheim with severe abdominal cramps in a fantasy birth of his child. According to Jones, Breuer fled, never saw her again, and took a vacation with his wife. On that trip, his youngest daughter was conceived (Jones, 1953, pp. 223–226). Kimball (2000) and other historians have concluded that this account is a myth: Breuer's daughter was born March 11, 1882, before Pappenheim's treatment ended; Breuer did see her several times later that year; and the childbirth fantasy was first mentioned by Freud fifty years later.

In 1888, Pappenheim, who never married, moved to Frankfort with her mother. She took a position as the director of a Jewish orphanage and became a leader of the Jewish community, an early feminist, and a founder of the profession of social work. Kimball (2000) aptly summarized her place in the history of psychoanalysis and psychology:

> Without her intelligent and perceptive explanation of her fantasy world, psychoanalysis would have had a very different beginning, or, arguably might not have existed at all. She was a central actor in the feminism of her day, and she was a major figure in twentieth-century Judaism before the Holocaust. She was able to engage life to the fullest. She transferred her own private pain into historic public action through an integration of her "blessed phantasy" with a strong sense of public duty. (Kimball, 2000, p. 41)

Bertha Pappenheim died in 1936. In 1954, the West German government issued a postage stamp of her portrait. Pappenheim was understandably sensitive about her relationship with Breuer, and all her life she refused to comment on her illness and treatment. When Breuer discussed her case with Freud, he respected her feelings and her friendship with Freud's fiancée by referring to her as Fraülein Anna O., the name by which she has come to be known. Freud was fascinated by her case and was to discuss it later in Paris with the leading nineteenth-century expert on hysteria, Jean-Martin Charcot, who, however, showed little interest. Anna O. and Josef Breuer both played important roles in Freud's developing interest in hysteria and the formulation of psychoanalysis. She has been described as the "best-known of all psychotherapy patients" (Hollender, 1980, p. 797).

Freud's Personal Use of Drugs

In the spring of 1884, Freud began to experiment with cocaine. He found that the drug relieved his feelings of depression, turned his bad moods into cheerfulness, and helped him work. He became an enthusiastic advocate of the drug and published six papers in the next two years describing its beneficial effects (Bernfeld, 1953). Cocaine seemed "a magical substance," and for the first time Freud felt himself to be a "real physician." He gave cocaine to his sister and sent some to his fiancée, Martha Bernays, "to make her strong and give her cheeks a red color" (Jones, 1953, p. 81). Freud himself took larger and larger doses and was fortunate not to become addicted. One of his friends for whom he prescribed the drug was not so fortunate: Ernst von Fleischl died a cocaine addict in 1891. At first, Freud's enthusiasm for cocaine was widely shared, but by 1885, numerous cases of cocaine addiction and intoxication had been reported, and alarm spread through the medical community. As an advocate of the drug, Freud was censured and rebuked by his colleagues. At first Freud argued that cocaine was dangerous when administered by injection, but not when taken orally. In fact, Freud had advocated injection of cocaine, and either mode results in addiction (Cioffi, 1974). Freud's most severe critic, Albrecht Erlenmeyer, labeled cocaine, along with alcohol and morphine, "the three scourges of humanity." Freud was deeply scarred by this "cocaine episode."

Though Freud was fortunate to have escaped cocaine addition, all his life he fought a losing battle against his addiction to another drug, nicotine. In 1894, when he was 38 years old, Freud's physician told him that his heart arrythmias were caused by smoking and advised him to stop. He continued to smoke heavily, often twenty cigars a day. During World War I, when the cigars he favored were scarce, Freud traded his wife's needlework for a supply. As a physician he was well aware of the risks he was taking, and many times he tried desperately to stop smoking, but always without success. When he was 67 years old, Freud noticed sores on his palate and jaw that failed to heal and were found to be cancerous. Yet he continued to smoke, rationalizing his decision by quoting George Bernard Shaw's warning, "Don't try to live forever, you will not be successful." Freud underwent a series of thirty-three operations on his mouth, throat, and palate. His jaw was almost completely removed and replaced with an artificial jaw Freud called "the monster." When he was in his seventies, a cancer specialist again advised him to stop smoking, but Freud refused to accept what he termed his "nicotine sentence" (Jones, 1957, p. 159); he continued to smoke heavily, for, as he said, "I have never been able to put up with having only a couple of cigars in my cigar case" (Freud, quoted by Jones, 1957, p. 121). Shortly before his death in 1939 Freud quipped, "I must be near death; they've stopped telling me my cigars will kill me" (Johnson, 1993, p. v). Freud's forty-five-year struggle makes him a tragic prototype of addiction to nicotine (Brecher, 1972, p. 215).

Freud and Charcot

The year 1885 was a good one for Freud. He was able to overcome the notoriety of the cocaine episode and was appointed a *Privatdozent* at the University of Vienna. He applied for a grant to study hysteria and hypnosis under Charcot in Paris. Such grants were very competitive, and their award was often political. Fortunately, Freud had Brücke's support and was successful. He traveled to Paris in October 1885 and remained there until February 1886, five months that changed his life.

Jean-Martin Charcot (1825–1893) was then at the peak of his fame and influence, with his stature in French medicine equaling Louis Pasteur's in chemistry. Charcot styled himself a neuropathologist but was acknowledged by others as the "world's greatest neurologist," and his La Salpêtrière clinic was recognized as the "Mecca of neurology" as students flocked there from many countries (Gelfand, 2000). The great attractions were Charcot's Tuesday demonstrations of hysterical phenomena and his lectures on hypnosis and hysteria. Freud saw Charcot's demonstrations of the induction and removal of hysterical symptoms through hypnotic suggestion and heard Charcot's claim that these symptoms were organically based but had psychological causes. Patients at the Salpêtrière showed "checkerboard" anesthesias, or paralyses, which came and went and did not follow anatomic principles. After just a month in Paris, Freud described Charcot in a letter to his fiancée, Martha Bernays:

> Charcot, who is one of the greatest physicians and a man whose common sense borders on genius, is simply wrecking all my aims and opinions. I sometimes come out of his lectures as from out of Notre Dame, with an entirely new idea about perfection. But he exhausts me. When I come away from him I no longer have any desire to work on my own silly things. . . . My brain is sated as after an evening at the theater. Whether the seed will ever bear any fruit, I don't know, but what I do know is that no other human being has ever affected me the same way. (Freud, November 14, 1885, in Freud, Freud, & Grubrich-Simitis, 1978, p. 114)

The most significant episode during Freud's time in Paris occurred neither at the Salpêtrière clinic nor in one of Charcot's lectures, but rather at one of the fabulous parties for which Charcot was well known. There Freud overheard Charcot describing the case of a young married couple; the wife was a confirmed invalid, and the husband was impotent. Charcot stated adamantly, "*Mais, dans ces pareils, c'est toujours le chose genitale, toujours, toujours, toujours, toujours*" (But in such cases, it is always a matter of sex, always, always, al-

Jean Charcot demonstrates hypnosis with his patient, "Wit."
(The Bettmann Archive)

ways, always). If that were the case, Freud wondered, why did Charcot not say so in his lectures and writings? Still, he was impressed that a neurologist of Charcot's stature should hold such a view (Clark, 1980a, chapter 4).

When Freud returned to Vienna, he translated one of Charcot's books, and in October 1886 he delivered a paper, "On Male Hysteria," to the Vienna Society of Physicians. Freud enthusiastically presented and endorsed Charcot's views, including his description of hysterical symptoms in males. Forty years later, in his autobiography, Freud recalled bitterly the hostile reaction to his presentation. The chairman described his views as "incredible," and one critic even asked sarcastically whether he was aware that the word *hysteria* had its root in the Greek word for uterus, *hysteron.* Male hysteria was described by some as an impossibility, and Freud was challenged to find a case of male hysteria in Vienna. He was able to meet this challenge and present such a case a month later.

This episode often has been described as the first of a number of occasions on which the medical establishment rejected Freud's views. Sulloway (1979) claims that accounts of this hostile reception are largely a myth created by Freud's misperceptions and his followers' view of him as a bold, courageous innovator. According to Sulloway, Freud's role as the self-appointed messenger from Paris was unnecessary, for Charcot's views on hysteria were well-known in Vienna. Also, Freud's view of Charcot was far too positive and uncritical. Many in the audience had a more realistic view of Charcot than did

Freud. Furthermore, a description of male hysteria was not as novel or revolutionary as Freud had implied, since others had previously provided descriptions of hysterical symptoms in males. The old uterine theory of hysteria had been widely discarded, and the baiting question about the origin of the word *hysteria* had been asked by a very old member of the society. The general reaction to Freud's presentation was probably not as hostile as he remembered it. According to Sulloway (1979), historically questionable accounts of this and similar episodes have contributed to the myth of Freud as a hero and revolutionary.

Freud's Medical Practice in Vienna

In 1886, Freud established a private medical practice at Berggasse 19 in Vienna. The treatment of hysteria was his specialty. At first he used conventional treatments—baths, massage, electrotherapy, and rest cures—but by 1889, Freud concluded that these procedures were not effective. He turned to hypnotism and returned to France to study the techniques of Liébault and Bernheim of the Nancy School of Hypnosis. Freud also translated Bernheim's 1888 book *De la Suggestion et de ses Applications à la Therapeutique* (On Suggestion and Its Therapeutic Applications). In Vienna, Freud used hypnosis in the case of Frau Emmy von N., an intelligent 40-year-old woman (Macmillan, 1979). Her most striking symptom was her habit of periodically interrupting a conversation to stretch her hands out in front of her face, which contorted with horror and disgust. She would say, "Keep still, don't say anything, don't touch me." Under hypnosis, Freud found that many of her fears related to childhood events. Some of her symptoms were alleviated by recalling such memories and some by direct hypnotic suggestion, but Freud did not consider her case a success. He became more and more dissatisfied with hypnosis as a therapeutic technique. Not all patients could be hypnotized, and those who could improved to different degrees. Some symptoms were unaffected, and some were relieved only temporarily. Freud concluded that his relationship with each patient was of more importance than any of the techniques he used. How could he improve this relationship and encourage patients to release their pent-up memories without hypnosis?

Psychoanalytic Techniques

Freud began to instruct his patients to try to remember events associated with the first appearance of hysterical symptoms. He found that some patients were able to recall and describe memories they had repressed for years. Often this recall was beneficial to them, just as it had been to Anna O. Freud began to rely more and more on a method of free association in which patients were asked to describe everything that came into their minds. He described this method as probing the depths of the human mind as an archaeologist excavates a buried city. At first Freud referred to this procedure as "Breuer's method," then as "psychical analysis," and finally as "psychoanalysis."

Freud begged Breuer to publish a description of Anna O. and his use of the "talking cure" to produce catharsis. The cautious and conservative Breuer was reluctant to do so. As he had an established reputation, his caution is understandable.[11] Finally, he agreed and published *Studien über Hysterie* (Studies in Hysteria) with Freud in 1895. They described Anna O. and four other hysterical patients. Even as they wrote this book, their views began to diverge. Breuer believed the crucial factor in the successful treatment of hysteria was to produce catharsis. The patient describes his or her symptoms as the therapist listens with care and attention. Freud accepted the importance of catharsis but saw much more significance in the patient-therapist relationship. Christopher Monte points to Freud's insight: that *Beneath the Mask* (Monte, 1980) of the clinical relationship there was much more than Breuer was willing to see:

> Breuer could not have known, but his patient viewed him, as all future analytic patients were to view their therapists, as father, lover, confessor, friend, rival, villain, and hero, calling up emotions for these changing perceptions of the therapist from previous relationships to important people in her life. (Monte, 1980, pp. 44–45)

Freud later described this process of projecting emotions and images from past relationships onto the therapist as *transference,* and the therapist's response as *countertransference.* Anna O. had transferred her feelings for her father to Breuer, and he in turn had countertransfered his love to her. Freud developed his transference theory more fully in his analysis of "Dora," a young woman of 18 referred to Freud by her father. Dora had accused her father of having an affair with the wife of Herr K. Herr K., in turn, Dora accused of having paid unwanted sexual attention to her since she was 14. According to Freud, Dora's intense longing for her father had been transferred to Herr K.[12]

Breuer was unable to accept Freud's analysis of his relationship with Anna O., and the professional relationship between the two men ended. Freud later recalled: "The development of psychoanalysis afterward cost me his [Breuer's] friendship. It was not easy for me to pay such a price, but I could not escape it" (Freud, quoted by Eissler, 1978, p. 33). Freud always acknowledged Breuer's influence on his thinking, with Breuer's first description of catharsis playing an especially important role. Breuer also served as an important role model, collaborator, and source of support for Freud. In return, Breuer described his feelings of awe and admiration for Freud and recalled that "he gazed after his soaring intellect as a hen at a hawk" (Jones, 1953, chapter XI). After they parted, Breuer treated a number of cases of hysteria on his own (Hirschmüller, 1987, pp. 316–319). But none of those cases had the impact or importance of Anna O.'s.

Freud's Seduction Theory

The years from 1885 to 1910 were Freud's great period of creativity and discovery. From 1887 to 1904, Freud corresponded frequently with a Berlin ear, nose,

[11] Ellenberger (1972) gives a critical review and additional data on the case of Anna O.
[12] Freud's analysis of Dora and the concept of transference has been attacked by Lakoff and Coyne (1993) in their book *Father Knows Best: The Use and Abuse of Power in Freud's Case of "Dora."*

and throat specialist, Wilhelm Fliess (1858–1928). When the correspondence began, Fliess was 29 and Freud 31. They had much in common: both were Jewish physicians, intensely ambitious, interested in sexual behavior. Fliess, like Freud, had spent time in Paris with Charcot. Freud and Fliess exchanged manuscripts and papers and commented freely on each other's work. Their correspondence provides an invaluable record of their relationship and of Freud's creative genius.[13] In 1937, Freud was astonished to learn that Fliess had preserved his letters. Freud considered them too personal and intimate for publication and begged their owner, the analyst Princess Marie Bonaparte, to destroy them. She showed strength and resolve in refusing to do so. The complete correspondence of 284 letters, translated and edited by Jeffrey Moussaieff Masson, was published in 1985. They show an intense relationship between the two men. Freud refers to Fliess as "my supreme arbiter" and finds his praise "nectar and ambrosia"; Fliess "panted after our congresses together." Freud would have named either of his two youngest children Wilhelm in honor of his friend, but they were both girls (Jones, 1953, chapter XIII).

Fliess believed that there are two fundamental life cycles: a male cycle of twenty-three days and a female cycle of twenty-eight days that should not be confused with the menstrual cycle. Within each cycle are peaks and valleys in physical and mental vitality. Fliess believed these cycles were related to the nose. He thought he had found a relationship between nasal irritation and various hysterical symptoms and sexual irregularities. Fliess diagnosed these ills by inspecting the nose and applying cocaine to "genital spots" on the interior of the nose. On two occasions, Freud arranged for Fliess to operate on one of his hysterical patients, Emma Eckstein. Fliess bungled the operation, leaving a gauze pad in the wound. The pad festered until another surgeon discovered and removed it a month later (Robinson, 1984, p. 32). Freud repeatedly reassured Fliess that he should not feel responsible for what had happened to Eckstein and characterized the continued nasal hemorrhaging she had experienced as psychosomatic.

According to Fliess's theory, humans are inherently bisexual, their life cycles start at birth, and events occurring early in life may have lasting effects. On October 15, 1895, in a letter to Fliess, Freud outlined his own new theory that hysterical and obsessional neuroses resulted exclusively from unconscious memories of sexual pleasure and excitation in early childhood. Freud proclaimed this major theoretical change: "Hysteria is the consequence of a presexual *sexual shock*" (Masson, 1985, p. 144). On November 2, 1895, Freud triumphantly reported to Fliess that he had found a case that supported his new theory:

> I'm glad I waited before mailing this letter. Today I am able to add that one of the cases gave me what I expected (sexual shock—that is infantile abuse in male hysteria!) and that at the same time a working through of the disputed

[13] Freud's friendship with Fliess began to decline around 1900, and their correspondence ended in 1904. Masson claimed that Freud's growing fame and his criticisms of Fliess's theory of periodicity caused the end of their friendship (Masson, 1985, p. 3).

> material strengthened my confidence in the validity of my psychological constructions. Now I am really enjoying a moment of satisfaction. (Masson, 1985, p. 149).

Those "psychological constructions" have come to be known as Freud's *seduction theory.*

In a January 1896 paper, Freud reported on sixteen such patients; in April 1896 in "The Aetiology of Hysteria," he presented eighteen fully analyzed cases, involving twelve women and six men, to the Vienna Society of Psychiatry and Neurology. Freud claimed to have uncovered experiences of sexual shock in *every one* of these patients. In less than six months, Freud had gone from his first formulation of the seduction theory to a confident assertion that hysterical symptoms were symbolic representations of early sexual traumas. Even Kurt Eissler, the former director of the Freud Archives and a strong supporter of Freud, has reservations about such a speedy confirmation of the seduction theory:

> One is impressed by the speed with which Freud went ahead with the publication of the seduction theory. Was a period of not quite four months really all that was needed to uncover the data in eighteen cases that confirmed such a surprising theory? (Eissler, 2001, p. 137)

Allen Esterson, an independent Freud scholar based in London, has written several excellent papers on Freud and his seduction theory. Esterson concluded that four months was not enough time, and that

> Freud alighted on his theory that a necessary precondition for hysteria and obsessional neurosis was a repressed memory of early childhood sexual excitation *before* he claimed to have uncovered such memories. (Esterson, 2002, p. 117)

In his papers, Freud reported that before analysis his patients knew nothing of these sexual incidents. They were often indignant and unbelieving when these incidents were brought to light under the pressure of Freud's clinical procedure (Esterson, 2001, p. 331). Freud reported that the perpetrators were generally nursemaids, teachers, older children, and strangers (Makari, 1998, p. 642). Beginning in December 1896, in his letters to Fliess, Freud implicated fathers in some of his current cases. Parental seductions, especially by fathers of their daughters, became increasingly central to the seduction theory.

His lecture on the etiology of hysteria, Freud wrote to Fliess, "had been given an icy reception by the asses" (Masson, 1985, p. 184); Richard von Krafft-Ebing, whose definitive *Psychopathia Sexualis* (1886) Freud had often cited, described Freud's work as a "scientific fairy tale," while another labeled it "horrible old wives' psychiatry" (Clark, 1980, p. 158). The claims of Freud and others that his lecture received a cool response for raising the issue of childhood sexual abuse have proved to be "largely mythological" (Esterson, 2002, p. 131). Freud's contemporaries did, in fact, raise legitimate criticisms of his methods and conclusions. Hysterical patients might have been especially susceptible to suggestions Freud unconsciously provided. At that time, Freud was using a quasihypnotic *pressure technique* as "the most convenient way of applying suggestion for the purpose I have in view" (Freud, 1895, pp. 109–111; Esterson, 2002, p. 118). Also, sexual abuse of children was not a taboo subject. Krafft-Ebing had documented several cases of such abuse, and his reports were well-known.

Within a year, Freud himself modified his claims. In September 1897, in a letter to Fliess, Freud admitted that he no longer believed in the seduction theory (Masson, 1985, p. 264). But he had no intention of telling anyone other than Fliess that he had been wrong as to the origin of hysterical symptoms (Masson, 1985, p. 265). It was not until 1905 in his *Three Essays on the Theory of Sexuality* that Freud admitted to his changed view. He acknowledged that normal persons may have experienced sexual experiences in childhood. Now he labeled the patients' recollections "fictionalized memories" or "fantasies." They were defenses against memories of infantile masturbation: the seduction was now a self-seduction. By 1914, the seduction theory had fallen under the weight of its improbability and contradictory evidence. It was now a "mistaken idea"; the memories were fantasies, protection from autoerotic memories. Freud's final report on the "interesting episode" of his seduction theory is in *New Introductory Lectures in Psychoanalysis* (1933):

> In the period in which the main interest was directed to discovering infantile traumas, almost all my women patients told me that they had been seduced by their father. I was driven to recognize in the end that these reports were untrue and so came to understand that hysterical symptoms are derived from phantasies and not from real occurrences. It was only later that I was able to recognize in this phantasy of being seduced by the father the expression of the typical Oedipus complex in women. (Freud, 1933, p. 120)

Although many have accepted Freud's account of the development and modification of the seduction theory,[14] others have been critics, one of whom wrote:

> In this article I want to persuade you that with the exception of the claim that Freud was practicing medicine in Vienna during the nineties, this story has about as much historicity as that of George Washington and the cherry tree or King Alfred and the cakes. (Cioffi, 1974, p. 172)

With less flair, but equal vehemence, others have made the following criticisms of Freud's seduction theory:

- As early as 1899, Leopold Lowenfeld reported he had seen one of Freud's patients: "By chance, one of the patients on whom Freud had used the analytic method came under my observation. The patient told me with certainty that the infantile sexual scene which analysis had apparently uncovered was pure fantasy and had never really happened to him" (Lowenfeld, 1899, p. 195; Schatzman, 1992, p. 35). Freud's response was to label him "the stupid Lowenfeld" (Masson, 1985, p. 412).

[14] Freud's account of the seduction theory was given in earlier editions of this book.

- Freud claimed that in three of his original eighteen cases he had independent confirmation that his patients had experienced sexual abuse in early childhood. Given the great difficulty is securing such evidence—what reaction other than denial would have been expected from a father asked to confirm that he had seduced his daughter! (Cioffi, 1974)—three such cases is impressive. But Smith (1991) examined these cases and found that the evidence adduced by Freud could not be substantiated (Smith, 1991, pp. 13–14).
- Allen Esterson[15] (1998, 2001) makes a convincing case that, rather than drawing his theories from his clinical observations, Freud's theories influenced his clinical reports.
- Patients' reports were not spontaneous, but the products of Freud's clinical technique. He warned his patients that they would recall infantile sexual scenes and strongly encouraged such reproductions. Failures to do so Freud interpreted as resistance, using a "pressure technique" to overcome that resistance. Freud would place his hand on his patient's forehead, ask him or her to close his or her eyes, and report anything that came to mind. The hand pressure was increased if the patient was unable or reluctant to do so (Esterson, 2001, p. 330).
- Freud actively reproduced his patients' reports. His technique was a "thrusting procedure" in which patients were "won over."
- Kurt Eissler has highlighted inconsistencies and incongruities in Freud's early papers on seduction theory. He writes: "The three papers are executed with such brilliance, conviction, and persuasiveness that repeated, meticulous readings are needed to discover the contradictions they contain and the shakiness of their foundation" (Eissler, 2001, p. 107).

Frank Cioffi concluded:

> Freud did not fall into the seduction error through believing his patients' stories; he did not fall into it through ignorance of the fact that persons sexually molested in infancy may, nevertheless, not succumb to neurosis; he did not fall into it through underestimating the frequency of seduction in the general population. Freud fell into the seduction error through the use of a procedure which to this day remains the basis of the psychoanalytic reconstruction of infantile life: the attribution to patients of certain infantile experiences because they appear to the analyst to be living through them with all the appropriate emotions. (Cioffi, 1974, p. 174)

Based on his thorough reading of Freud, his supporters, and his critics, Esterson wrote:

> In particular, the documentary evidence adduced in this article demonstrates that Freud's accounts of how his discovery of unconscious incestuous phantasies emerged from the seduction theory episode do not accurately portray the events they purport to describe. (Esterson, 2001, p. 345)

[15] I am pleased to acknowledge Allen Esterson's valuable assistance in bringing to my attention not only his own impressive scholarship on Freud's seduction theory, but also the contributions of others.

It is ironic that one of the best-known critiques of Freud's seduction theory is based on just those inaccurate accounts, creating "a new fable based on old myths" (Esterson, 1998, p. 1). In 1984, Jeffrey Moussaieff Masson published *The Assault on Truth*, asserting that Freud had dishonestly disavowed his discovery of infantile seduction. Earlier critics had also concluded that Freud was wrong to abandon his theory that neurosis is often the result of childhood sexual abuse and that he did so to placate public opinion and rehabilitate his reputation in Vienna (Rush, 1980; Herman, 1981). But Masson's best-selling book brought these charges to the attention of a much wider public. He argued that had Freud remained faithful to his original seduction theory, the entire history of psychoanalysis would have been different. Instead of exploring the imaginary sexual lives of children, psychoanalysts would have brought real sexual abuses of children to light (Crewdson, 1987). Masson depicted the changes in Freud's seduction theory as emblematic of an all-too-frequent practice of psychoanalysts: to explain away real social evils such as child molestation and sexual abuse as fantasies.

Critics have found Masson's description of Freud's motivation and the changes in his seduction theory unconvincing:

> Although Freud was often dogmatic and sometimes wrong, he was far too proud, too used to isolation, and too honest to discard a theory because it was unacceptable [to others]. Everything we know about his character makes Mr. Masson's accusation wildly unlikely. (Storr, 1984, p. 35)

Esterson concluded, after examining Masson's evidence and argument:

> Jeffrey Masson has produced an erroneous account of the seduction theory episode which, as Rycroft writes, demonstrates "his incapacity to distinguish between facts, inferences, and speculations" (Rycroft, 1991, p. 75). His errors result from his failure to grasp the nature of the clinical procedure Freud was using, his uncritical presumption that the latter's clinical claims were valid, and his acceptance of Freud's historical accounts in spite of the scholarly research which has shown them to be unreliable. (Esterson, 1998, p. 15)

The Interpretation of Dreams

During these years, Freud also discovered dreams as a "royal road" to the unconscious (Jones, 1953, p. 351) and an invaluable tool in probing the unconscious mind. He distinguished between the manifest content of dreams—the events, situations, objects, and people we dream about—and the dream's latent content—the underlying meaning of the manifest dream elements. Typically, for Freud, the latent content represents repressed wishes and desires. To understand latent content, we must decipher and interpret the special language of dreams—hence the title of Freud's *The Interpretation of Dreams* (1900). While this book is now considered a classic and is read widely, when it was first published it was not a success. After two years, only 351 copies had been sold, and it took six more years before the entire first printing of 600 copies had sold. In later years, though, it sold well, and eight editions were published in Freud's lifetime. The book influenced many readers. Hanns Sachs, a German analyst, wrote:

> My first opening of the *Traumdeutung* [Interpretation of Dreams] was the moment of destiny for me—like meeting the *femme fatale,* only with a decidedly more favorable result. Up to that time I had been a young man who was supposedly studying law but not living up to the supposition—a type common enough among the middle class in Vienna at the turn of the century. When I had finished the book, I had found the one thing worthwhile for me to live for. (Sachs, 1944, quoted by Momigliano, 1987, p. 375)

The Interpretation of Dreams is Freud at his most intriguing and stimulating, and he considered it the most important of all his works (Clark, 1980, p. 181).

The Psychopathology of Everyday Life

While writing *The Interpretation of Dreams,* Freud discovered another "road to the unconscious" in such everyday events as slips of the tongue and pen, temporary failures of memory, and trivial mistakes. These psychopathologies of everyday life were described in another classic book published under that title in 1901. Freud gave many examples of slips of the tongue[16] he believed were symptomatic of unconscious dynamics. For example, the president of the lower house of the Austrian Parliament, expecting a stormy debate, opened the session with the declaration, "Gentlemen, I notice that a full quorum of members is present and hereby declare the meeting closed" (Freud, 1901, p. 77). When one of his patients returned from visiting her uncle, Freud asked how he was. She replied, "I don't know, I only see him now in *flagrante.*" The next day she corrected herself, explaining that she had meant to say *en passant* (Freud, 1901, p. 83). *Flagrante delicto* is a legal term meaning while the crime is being committed; *en passant* means in passing. A Jewish man who had recently converted to Christianity told his children to go into the garden, but called them Juden (Jews) instead of Jungen (children) (Clark, 1980a, p. 206). Such seemingly trivial accidents and mishaps as husbands who repeatedly lose their wedding rings or misplace their car keys before driving to an important event were, for Freud, indicative of unconscious conflicts and wishes.

Freud's Theory of Personality Development

In the first decade of the twentieth century, Freud also developed his psychosexual theory of personality development. Freud believed every individual progresses through a number of stages—oral, anal, phallic, latent, and genital—with each stage characterized by a conflict between the gratification of instincts and the limitations of the external world. If the child receives too little or too much satisfaction at any stage, he or she may not be able to move easily to the next stage of development. Under- or over-gratification may also result in fixation, or an investment of a portion of libidinal energy at that stage,

[16] Related verbal phenomena are "tips of the slongue or Spoonerisms" (Gibbs, 2001), named after William Augustus Spooner (1844–1930) who at a wedding ceremony told the nervous groom, "Son, it is kisstomary to cuss the bride"; and complained that his students had "hissed my mystery lecture" and "tasted the whole werm." At a college dinner, Spooner once raised his glass and proposed a toast to "the queer old dean."

leading to behaviors later in life that are characteristic of the conflict during that particular stage.

One of the most controversial ideas in Freud's theory of personality development was the *Oedipus complex.* Freud suggested that during the phallic stage of a boy's development, he experiences sexual longing for his mother and hostility toward his father. Resolution occurs when the boy experiences fear of castration by his father and overcomes this fear by identifying with him. Freud used the term *Electra complex* to describe the experience of a young girl during the phallic stage. Later, Freud argued against the introduction of this term in his paper "Female Sexuality" (Strachey, 1966, p. 194), because it emphasized analogous development in the two sexes, a view Freud could not endorse. He preferred the term *castration complex* for the female, believing that her trauma centered on her disappointment in discovering that she already had been castrated, presumably by her mother. Also, Freud believed that female development, unlike development in the boy, which generally follows only one course, may follow one of three possible lines. The first results in a general revulsion against sexuality. The second leads the girl to cling to the hope of obtaining a penis and the fantasy of being a man. Freud suggested that this "masculinity complex" may also result in the choice of a homosexual orientation. In the third line of development, the girl surmounts her pre-Oedipal attachment to her mother and takes her father as her love object, thus developing a feminine attachment to the father and a feminine sexual orientation (Strachey, 1966, pp. 229–243).

Freud believed that his broader theory of personality, his "scaffold of the mind," was his most important contribution to psychology. He conceived of the mind as consisting of three separate but independent structures: the *id, ego,* and *superego.* The *id* is completely unconscious and the source of basic impulses and drives; it is the biological reservoir that underlies all actions. The id operates in accordance with the "pleasure principle" and seeks immediate gratification and satisfaction. The *ego* derives its energy from the id, but it is the instrument of reason and sanity. It attempts to meet the id's demands within the limitations of reality; hence, it operates in terms of the "reality principle." Much of the ego is conscious, and it uses memory, perception of the environment, and habits to perform the role of a rational executive. Finally, the *superego* incorporates absolute standards of morality and ethics and plays the role of the "great naysayer and prohibitor." Certain avenues of satisfaction are off limits, and so, loosely speaking, the superego plays the role of the conscience.

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Freud saw the ego as serving three masters: the id, with its demands for immediate gratification and release of tension; the superego, with its prohibitions and restraints; and the world, the reality in which the person lives. Freud sometimes compared the relationship between the ego and the id to that between a charioteer and his horses: the horses provide the energy and drive, and the charioteer provides direction. In the healthy personality, the three components work together in harmony, largely as a result of a strong ego; in the hysterical or neurotic personality, they do not. At times Freud wrote as though the id, ego, and superego were real entities resident somewhere within the person. It is important to remember that they are only metaphors.

Freud and His Followers

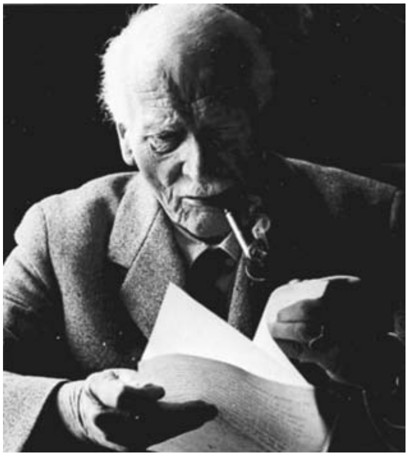
With his increasing fame and importance, Freud attracted many followers. He saw himself as their leader, teacher, and prophet. Starting in 1902, a group of five men, including Freud and Alfred Adler (1870–1937), met on Wednesday evenings in Freud's waiting room in Vienna. They came to be known as the Wednesday Psychoanalytical Society. By 1908, this group had expanded to twenty members and changed its name to the Vienna Psychoanalytical Society. When Adler developed critiques of Freud's sexual theory of hysteria and hypnosis, the two men became estranged. By 1911, Adler was forced to resign from the Vienna Psychoanalytical Society and took nine of his followers with him. Adler then founded a school of "individual psychology" that emphasized social factors and the unity of health and harmonious behavior (McGee, Huber, & Carter, 1983). Adler's school of individual psychology competed with Freud's orthodox psychoanalysis.

An even more bitter estrangement developed between Freud and Carl Jung (1875–1961). Their correspondence began in 1906, after Jung sent Freud a copy of his book describing his research on association tests. During the next seven years, they exchanged frequent letters, 360 of which have survived (McGuire, 1974). Freud and Jung's correspondence shows a clear change in their relationship. At first, Jung is the submissive student, eager to learn from Freud; later he is the "crown prince" and ordained successor. Seven years later, after Jung had immersed himself in mythology and had developed concepts unacceptable to Freud, such as the collective unconscious, correspondence between the two men ended with this terse letter (McGuire, 1974, p. 94):

> Dear Professor Freud,
>
> I accede to your wish that we abandon our personal relations, for I never thrust my friendship on anyone. You yourself are the best judge of what this moment means to you. The rest is silence. . . .
>
> Yours sincerely, Jung.

Jung and his Swiss colleagues were expelled from the psychoanalytical movement in 1914.

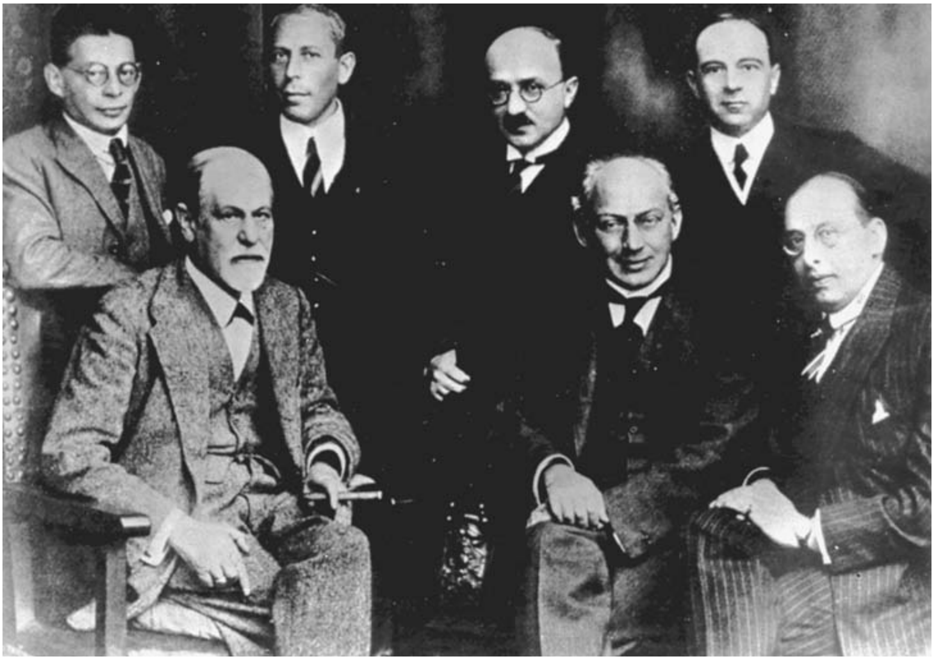
Freud was authoritarian, paternalistic, and dogmatic. He was unable to tolerate disagreements or accept challenges from his followers. He saw them as his children, his disciples, and he expected them to accept what he said without question. Disagreements were acts of treason, and dissenters were often vilified (Roazen, 1975). In reaction to the defections of Adler and Jung, Freud established in 1912 a secret committee of loyal adherents to ensure purity and orthodoxy. The 1912 photograph of the committee that appears in this chapter hung in Freud's waiting room. Freud gave each of the men in the committee a gold and carnelian ring (Grosskurth, 1991). The committee continued to meet in secret to plot the course of the psychoanalytical movement and repulse critics until 1927, when it merged with the official board of the International Psychoanalytical Association. Rank, Abraham, Ferenczi, and Sachs became well-known psychoanalysts; Jones is best known for his biography of Freud.



Carl Jung.
(Henri Cartier Bre sson/Magnum)

Max Eitingon is an intriguing figure. He was a wealthy businessman who was analyzed by Freud and acted as his social secretary from 1925 to 1937. In a history of the Soviet secret police, the KGB, historian John J. Dziak made the startling charge that Eitingon was an active member of the KGB throughout this period and was involved in Stalinist purges and executions (Schwartz, 1988).

Though not part of Freud's inner circle, women analysts rose to high positions within the psychoanalytical movement and were successful theorists and highly regarded therapists (Thompson, 1987; Appiganesi & Forrester, 1992). Freud's daughter Anna (1895–1982) was the most loyal of his followers (Young-Bruehl, 1988). She qualified as a schoolteacher in 1915 and taught for six years. Anna Freud did not attend medical school, but instead was tutored by her father. She later described her analytical training as "thoroughly irregular, if not disorganized" (Anna Freud, quoted by Fine, 1985, p. 230). Their father-daughter relationship was governed both by Freud's faith that Anna would not be like other girls and by Viennese expectations of appropriate roles for women. Anna Freud struggled to achieve "like a man" but to "dance and be generous" like a woman (Young-Bruehl, 1988, pp. 127, 129). She developed psychoanalytical techniques for children and such innovative methods as play therapy (Viner, 1996). She also established the first day nursery in Vienna. Anna Freud dedicated her life to her father. She never married, and she acted as his confidante, secretary, and companion. She went into exile with Freud in 1938, and in 1947 she established the Hampstead Child Therapy Clinic in London. That center was largely supported by American funds—which was ironic, as Anna Freud reportedly hated America (Fine, 1985, p. 230). One consequence of this financial support was that American students received preference at the center, so that many American students were trained there. Anna Freud's lasting legacy is the extension of her father's psychoanalysis to children. Once, when one of the



Freud with members of the "Committee." In the back row, from left to right, are Otto Rank, Karl Abraham, Max Eitingon, and Ernest Jones. Freud sits at the left front with Sandor Ferenczi and Hanns Sachs to his left.
(The Bettmann Archive)

youngsters at her clinic asked her how many children she had, Anna Freud replied honestly, "I have many, many children" (Barlow, 1991, p. 389).

Karen Horney (1885–1952) taught at the Berlin Psychoanalytical Institute, of which she was a founding member. In 1932, Horney joined the Chicago Psychoanalytic Institute, and in 1934, she became a staff member at the New York Psychoanalytical Institute (Quinn, 1987). Horney founded the Association for the Advancement of Psychoanalysis in 1941. Between 1922 and 1935, Horney wrote fourteen papers in which she challenged Freud's antifeminist bias and stressed social rather than biological determinants of sex differences and "feminine psychology." Horney was a potent critic of Freud's views of women. According to Horney, women envy not male anatomy, but rather the opportunities and power that are available to men but so often denied to women. Horney wrote that:

> The assertion that one half of the human race is discontented with the sex assigned to it and can overcome this discontent only in favorable circumstances is decidedly unsatisfying. (Horney, quoted by Dinnage, 1987, p. 11)

Horney's emphasis on the social determinants of neuroses and her rejection of such Freudian cornerstones as the Oedipus complex were important

Anna Freud with her father.
(UPI/Bettmann)

modifications to psychoanalytic theory (Quinn, 1987). Other important women analysts included Melanie Klein, Helene Deutsch, and Marie Bonaparte (Bertin, 1982).

Recognition and Success

At the beginning of the twentieth century, Freud's position within the intellectual world was assured. His invitation to the Clark Conference (Chapter 9) signified his growing international reputation (Rosenzweig, 1992). After World War I, Freud's fame continued to grow, and he was in great demand as a therapist. He attracted large numbers of patients, many from America, and was able to command hourly fees two or three times those of his colleagues in Vienna. But Freud admitted that he had "never been a therapeutic enthusiast" (Roazen, 1975, p. 133) and had "become a therapist against my will" (Roazen, 1975, p. 134). Anna Freud once called psychoanalysis "a stupid way to live" (Young-Bruehl, 1988). Freud had no desire to be the savior of humanity, and he always acknowledged that his aim was to understand human nature rather than to help individuals. "I prefer a student to a neurotic ten times over," Freud is reported to have said (Freud, quoted by Momigliano, 1987, p. 376). Freud's expectations for therapy were limited, yet he continued to see large numbers of patients because he needed the money, wanted to confirm his theoretical speculations, and wanted to maintain his grip on the psychoanalytical movement through his analyses of analysts in training.

Roazen also shows that some Freudian orthodoxies are nothing more than conventions. Freud was quite dismissive of the need for analysts to have a medical degree and did not have a high opinion of the medical profession. He believed that "lay analysts" who were not medical doctors could function quite adequately. Freud adopted the classic position of the analyst, sitting behind the patient's couch, only because he disliked being stared at all day; he often analyzed his friends and relatives and socialized with his patients, behaviors that later analysts considered taboo. Analysis with Freud usually lasted only a few weeks, rarely more than two months; later it was to become a process that often lasted years. Freud also had a strong interest in the occult and a low opinion of America and Americans. His daughter Anna insisted that her father's anti-American opinions be excised from his authorized biography (Jones, 1953), since by that time New York City was the psychoanalytical capital of the world. It also may come as a surprise to learn from Roazen that Freud, the discoverer of infantile sexuality, sent his own sons to the family doctor to learn the facts of life (Roazen, 1975, p. 58).[17] It was Freud, the world authority on human motivation, who wrote to Marie Bonaparte that "the great question that has never been answered and which I have not yet been able to answer, despite my thirty years of research into the feminine soul, is 'What does a woman want?' " (Freud, 1966, p. 244).

Freud in Exile

Freud tragically underestimated the danger posed by the Nazis. According to his biographer, Ernest Jones, Freud ardently believed that the Germans would contain the Nazi movement, for "a nation that produced Goethe could not possibly go to the bad" (Jones, 1957, vol. III, p. 151). At the Leipzig Congress of Psychology in 1933, psychoanalysis was branded "Jewish science," and it was subsequently banned in Germany. The Berlin Psychoanalytical Institute, founded in 1921, was closed. Even after the Nazi occupation of Austria in March 1938, Freud continued to deny the reality of the danger. Roazen (1991) reports that Freud even clung to an irrational belief that the Italian fascist dictator Benito Mussolini would protect him. In the midst of terror and danger, both Freud and his wife retained a sense of humor and detachment. When Nazi soldiers came to their home, Freud's wife, Martha, asked them to leave their rifles in the umbrella stand in the hall. They searched the apartment, and when

[17] Two of Freud's grandsons have been prominent in England. Clement Freud was a liberal Member of Parliament and the host of a popular television cooking program. He was knighted Sir Clement. Lucien Freud is a well-known figure painter whose arresting, realistic close-ups of nudes sell for very high prices. A portrait of the Queen was less successful; critics described it as making the Queen look like Jack Nicholson or one of her Corgi dogs.

they had left, Martha informed her husband that they had taken an amount of money worth about $840. "Dear me," Freud remarked, "I have never taken that much for a single visit" (Hofmann, 1988, p. 21). While Hitler and his cohorts had probably never read a word of Freud's books, they considered them a slur on their civilization. They destroyed many of the books in Freud's personal library and the library of the Viennese Psychoanalytical Society. The Nazis built a public bonfire with all the books on psychoanalysis from the Vienna Public Library. Freud commented, "What progress we are making. In the Middle Ages they would have burnt me; nowadays they are content with burning my books" (Eissler, 1978, p. 21). Freud was a sick man at the time, but he was determined to remain in Vienna as he feared that changing his doctors would shorten his life. Freud was also tormented by feelings of guilt about the prospect of deserting his homeland like a captain leaving a sinking ship. Jones reassured him with the story of the officer who was blown to the surface by a boiler explosion when the Titanic sank. When the Commission of Inquiry sternly asked him, "At which moment did you leave the ship?" he proudly answered, "I never left the ship, Sir; she left me" (Jones, 1953, vol. 1, p. 294).

After the Gestapo interrogated Anna Freud, she asked her father, "Wouldn't it be better if we all killed ourselves?" Ever the analyst, Freud answered, "Why? Because they would like us to?" (Wyden, 1992, p. 64). Finally friends and colleagues were able to persuade Freud to seek refuge in exile. Princess Marie Bonaparte, one of his analysands, paid a ransom (refugee tax) for his release, but before he could leave, the Nazis insisted that he sign a statement that they had treated him and his family well. To this statement, Freud added the comment, "I can most highly recommend the Gestapo to anyone" (Clark, 1980a, p. 511). The Gestapo either failed to see the irony or chose to ignore it. In 1938, Freud left the home at Berggasse 19 he had occupied for nearly forty-seven years. An American, Sanford Gifford, a student at the Psychoanalytical Institute, described Freud's situation:

> I understand that there were lengthy negotiations with the Nazis concerning his departure from the country. The exact nature of these negotiations I do not know, but finally they were worked out and the family was granted a permit to leave. A permit to leave, however, was not always what it pretended to be. In many cases, so it was alleged, many prominent persons were granted such permits and allowed to board the train for their intended destination. When they reached the border, however, Nazi officials boarded the train to check thoroughly the possessions that the émigré was taking with him. This frequently led to a great deal of harassment and often resulted in a rescinding of the permit and the émigré's removal from the train. This was a very real danger in the case of the Freuds. (Langer & Gifford, 1978, p. 44)

Sir Samuel Hoare, the British Home Secretary, and Cordell Hull, the United States Secretary of State, used their influence on Freud's behalf. Even President Roosevelt was instrumental in pressuring the Nazis to issue exit permits for Freud and his family (Hofmann, 1988, p. 21). The American journalist and historian Walter Langer volunteered to accompany them on the train. At the German-French border, Nazi officials boarded the train to interrogate the emigrants. Langer stationed himself outside the Freuds' compartment, making it clear that he, an American, was keeping a close eye on the officials' behavior.

Some people were removed from the train, but Freud and his daughter Anna were not. They arrived safely in Paris, where they were received by William C. Bullitt, the American Ambassador to France and a former patient of Freud's; Freud's coauthor, Marie Bonaparte; and Freud's son Martin.[18] Some of Freud's family remained in Vienna, and four of his five sisters were murdered in Nazi death camps. After a few days in Paris, the family journeyed to London, on September 27, 1938. Through the good offices of Ernest Jones, they found refuge at 20 Maresfield Gardens in Hampstead. Freud had been elected to the Royal Society in 1936. He was also well known to the general public. Correspondence addressed to Freud, London was delivered. Later Anna Freud was to establish her Hampstead Child Therapy Clinic across the road at 21 Maresfield Gardens. Freud was able to attend occasional meetings and seminars at the London Psychoanalytical Society and saw patients until a few weeks before his death. However, he was in great pain, and on September 21, 1939, he reminded his physician, Max Schur, of their agreement to end his life should the pain become intolerable. Schur injected Freud with three centigrams of morphine, followed by two more injections on September 22. Freud died at three in the morning on September 22, 1939 (Gay, 1998). He was 83 years old.

Freud's Biographers

A vast literary, popular,[19] and scholarly genre is devoted to Freud, but he has been most fortunate in his biographers. Ernest Jones published the authorized biography (Jones, 1953–1957). The three-volume work is a flattering and even heroic portrait of Freud. As one reviewer said of the Jones biography, "It reveals to its readers everything about Freud that Anna Freud thought fit to print" (Wollheim, 1988, p. 3). Paul Roazen in 1975 stressed the conflicts and dissensions swirling around Freud, while Frank Sulloway (1979) sought to debunk what he considered the historical myth of Freud as victim and hero. Ronald Clark (1980a) wrote a detailed life of Freud, paying special attention to the social and scientific backgrounds behind his work. Peter Gay (1998) presented Freud as a great thinker who had a profound influence on Western thought and civilization. All these are excellent biographies, but it is Freud's own writings that show his powerful and subtle mind grappling with the imponderables of human experience.

One demonstration of Freud's continuing influence on Western thought and culture was an exhibit entitled "Sigmund Freud: Conflict and Cult" at the Library of Congress in Washington, D.C. The ambitious exhibit was drawn from the Library of Congress's collection of more than eighty-thousand Freud artifacts, together with loans from the Freud Museums in London and Vienna.

[18] Martin's estranged wife Esti and their daughter Sophie remained in France when the rest of the family left for London. They rode bicycles across France to escape the Nazis, fled to Morocco, and then to New York. In America, Sophie Freud was a college teacher and writer. Some of her works focused on her aunt Anna Freud (English, 2002).

[19] Freud made four appearances on the cover of *Time* magazine in 1924, 1939, 1956, and 1993. In November 1993, *Time*'s cover portrait of Freud was emblazoned with the question "Is Freud Dead?" He would surely have appreciated the irony of the question.

The Freud Museum

The house where Freud spent his last days at 20 Maresfield Gardens in Hampstead, London, is now the site of the excellent Freud Museum. The museum's library contains the 2,500 books Freud brought from Vienna. They reveal his wide interests in art, literature, archeology, philosophy, history, psychology, medicine, and psychoanalysis. The museum also owns 15,000 pages of documents; 3,800 photographs, 200 pictures and paintings, including *The Lesson of Dr. Charcot,* which Freud hung over his couch in Vienna; a portrait by Ferdinand Schmutzer that Freud considered his favorite; and a pen-and-ink drawing by Salvador Dali based on a sketch Dali made surreptitiously during a meeting with Freud on July 19, 1938. Many of Freud's collection of 1,900 archeological artifacts are on display, including the figure of a Chinese sage that sat on his desk and that Freud greeted each morning. The house is furnished as it was when Freud, his wife Martha, daughter Anna, son Ernst, daughter-in-law Minna Bernays, and Anna's friend Dorothy Burlingham lived there. Anna Freud lived in the house until her death in 1982. In accordance with her wishes, the house was turned into a museum and opened to the public in July 1986. The consulting room includes Freud's famous couch. The museum is open to the public for individual or group tours. A virtual tour of the Freud Museum is also available on the Internet.

In my visit to the Freud Museum, I was especially moved by a BBC video recording of a statement Freud made in December, 1938, less than a year before his death. His jaw cancer had advanced to an incurable and obviously painful state. Freud speaks in heavily accented but correct English. He ended his statement with these words:

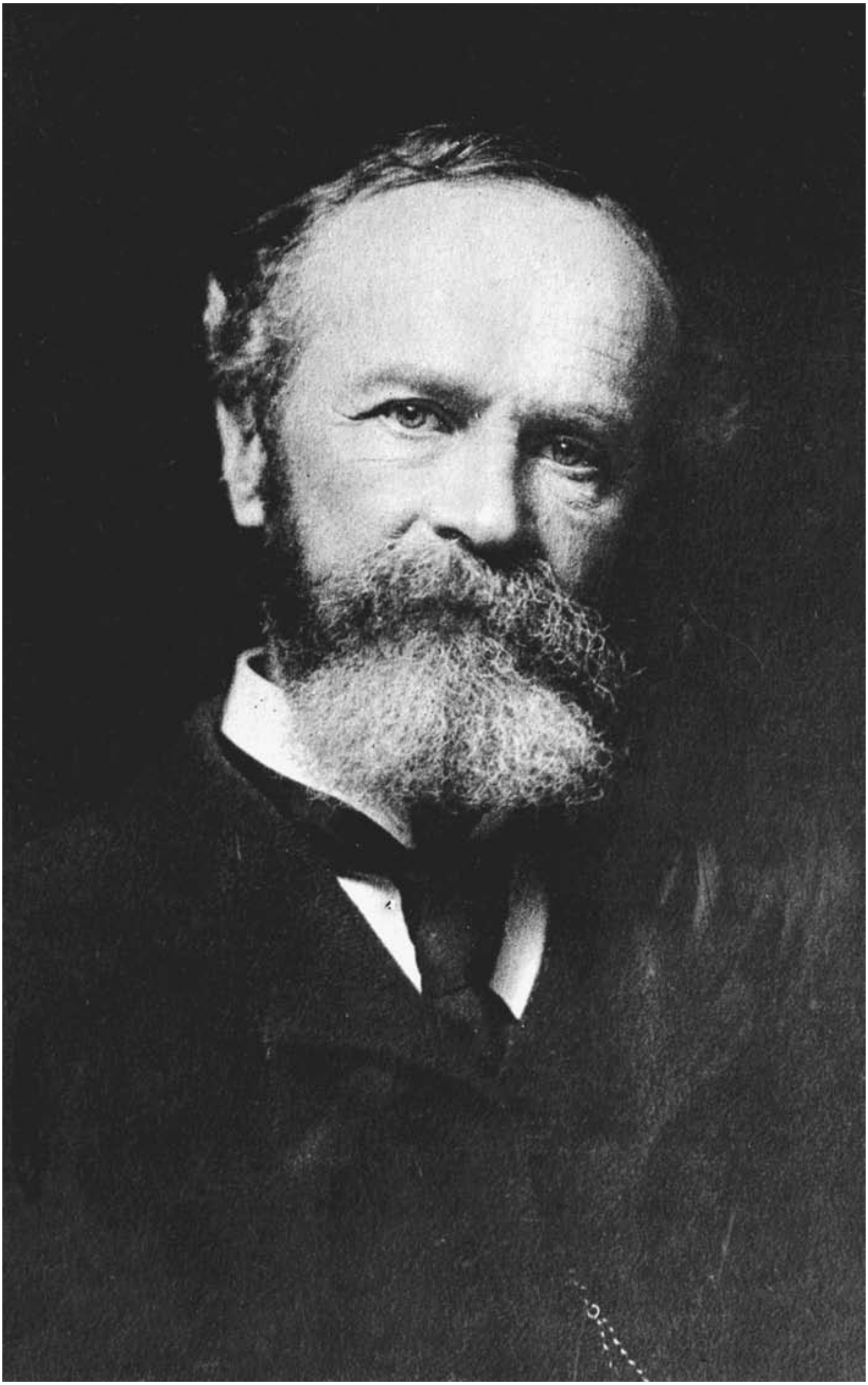
> As a result of the German Invasion, I left my home in Vienna and came to England, where I hope to end my life in freedom.

From October 1998 to January 1999 at the Library of Congress, and in the next two years at the Jewish Museum of New York, the Sigmund Freud Museum in Vienna, and the Skirball Cultural Center of Los Angeles, hundreds of thousands of people visited the exhibit to learn more about Freud (Merkin, 1998). The exhibit presented Freud as one of the most decisive and influential figures in the course of modern cultural history. While acknowledging the controversy he stimulated, and though marred by the seemingly inevitable "Freudian slippers" and "Freudian sip mugs" for sale in the gift shops, the exhibit was impressive in its depth and in its respect for Freud and his contributions. His place in history seems secure.

CONCLUSION

Over many centuries, demonological, satanic conceptions of mental illness slowly gave way to the realization that mentally disturbed people are ill and need special care and treatment. As this realization grew, parallel changes occurred in institutions for the mentally ill. At first, such institutions were nothing more than barbaric prisons, but in the eighteenth and nineteenth centuries the efforts of such enlightened reformers as Pinel, Guggenbühl, Tuke, and Dix led to reforms and the establishment of relatively enlightened institutions. Unhappily, early in the twentieth century, these institutions found themselves overtaxed by the large numbers of people committed to them. All too often, the institutions regressed to serving a purely custodial function. Only in recent decades has further progress been made in the care and treatment of persons with mental illness.

In the history of approaches to the treatment of mental illness, we see a similar progression from punitive and physical procedures to more enlightened attempts to understand and treat mental disorders. Freud's development of psychoanalysis and his successors' later modifications, together with the development of psychoactive agents (drugs) and other approaches to therapy, have revolutionized the treatment of mental illness.



William James.
(Brown Brothers)

CHAPTER 9

Darwin, Galton, Cattell, James, and Hall

The *functionalists* formed the first major non-German school of psychology; they will be discussed in Chapter 10. Like the *Gestalt* psychologists (Chapter 7), the functionalists sought a new, more dynamic psychology, but in their case it was a psychology that would study the functions of the mind and the adaptive value of consciousness. Such interests and concerns were a product of the intellectual climate of the nineteenth century, which was dominated by Charles Darwin's theory of evolution.

CHARLES DARWIN (1809–1882)

Darwin's Early Life

Charles Darwin was born the fifth of six children in England on February 12, 1809, the day Abraham Lincoln was born in Kentucky. Darwin's family was wealthy, socially secure, well-connected both socially and intellectually, and involved in progressive causes such as the antislavery movement. His grandfather, Erasmus Darwin, was a prominent physician with strong interests in biology and natural philosophy. In *Zoonomia,* Erasmus Darwin proposed a natural explanation for the origins and development of life. At the time of his birth, Darwin's father, Robert Darwin, is said to have been England's highest paid provincial physician (Fancher, 1993a, p. 1); his mother Susannah was a member of the famous Wedgwood pottery family. The exciting story of Darwin's life and his formulation of the theory of evolution has been told many times: by Darwin himself, in an autobiography edited by his granddaughter Nora Barlow (Barlow, 1958); by Alan Moorehead, in a series of articles and a book (Moorehead, 1969a, 1969b); in a major biography by Ronald Clark (Clark, 1986); and by Irving Stone, in a best-selling novel (Stone, 1980). The pivotal experience of Darwin's life was his five-year stint as the naturalist on the round-the-world voyage of the Royal Navy survey ship *H.M.S. Beagle.* Darwin embarked on this voyage on December 27, 1831, shortly after receiving a B.A. degree at Cambridge. His academic record had been undistinguished, leading his father to upbraid him when he was 15 years old with this unhappy characterization and prediction: "You care for nothing but shooting, dogs, and rat-catching, and you will be a disgrace to yourself and all your family" (DeBeer, 1971, p. 565).

First, Darwin was sent by his father to study medicine at Edinburgh University. But upon observing surgical operations performed without anesthesia, Darwin ran from the operating theater, resolved never to return. In 1828, he entered Christ's College to prepare for the ministry of the Church of England. At Cambridge Darwin was described as being "of the most placid, unpretending, and amiable nature" but also as "a fellow who was forever asking questions" (Clark, 1986, p. 15). He graduated in 1831 with a "poor" (third-class) degree and vague plans to be a country parson and naturalist. Darwin hoped to emulate the one Cambridge man he admired, Professor John Stevens Henslow (1796–1861). Henslow was a clergyman and botanist whom Darwin accompanied on so many field trips that he became known as "the man who walks with Henslow." Darwin enjoyed being out in the country and collecting plant and animal specimens. On one trip, Darwin found a rare beetle, then another, and then a third; he popped them into his mouth for safekeeping as his hands were full (Clark, 1986, pp. 8–9). Through a combination of chance and happy circumstance, Darwin was offered a position as naturalist on board the *Beagle.* His father strenuously objected to his accepting the position, and, as fathers are wont to do, listed his objections: it was a wild scheme and a useless undertaking; the voyage would be long, and accommodation would be most uncomfortable on a small naval ship of the class known as "coffins" due to their unfortunate tendency to capsize; the position had been offered to others, including Henslow, who had shown good judgment in turning it down; the position was unsalaried and would cost Darwin the large sum of two thousand pounds; and, finally, no person of "common sense" would recommend that he go. Fortunately Darwin was able to find just such a person, his uncle Josiah Wedgwood II, a successful businessman who not only recommended that Darwin take the position but also paid his expenses.

The *Beagle's* captain was Robert Fitzroy, a staunchly religious man who believed in the historical accuracy of the account of creation given in the Bible's book of Genesis. Fitzroy hoped that a trained naturalist would be able to find evidence at the *Beagle's* many landfalls around the world to prove that the biblical account was true. When he left on the *Beagle,* the 22-year-old Darwin was a firm believer in the biblical account of creation. He later recalled that early in the voyage, the more worldly ship's officers often laughed at him when he quoted the Bible as an absolute and final authority. What Darwin saw during the *Beagle's* five-year, forty-thousand-mile voyage changed his mind and altered forever the scientific, theological, artistic, and literary conceptions of the human condition.

The Voyage of the *H.M.S. Beagle*

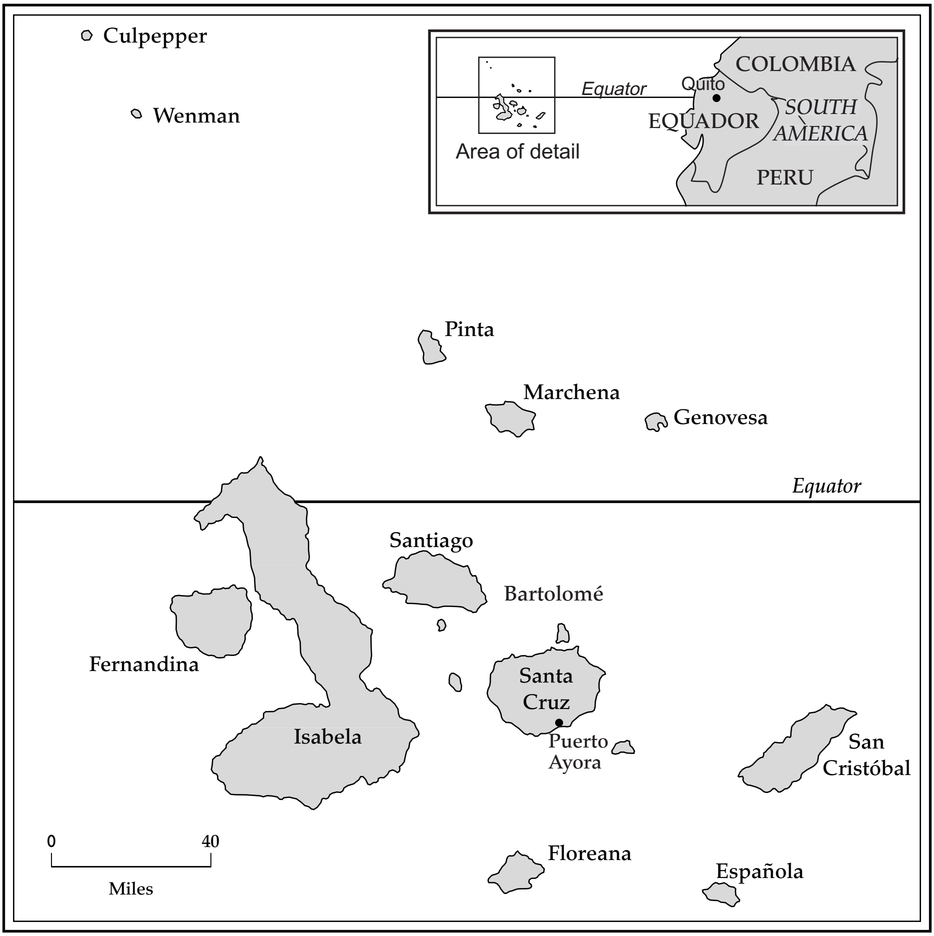
As Fitzroy had planned, Darwin left the *Beagle* and traveled inland at the ship's many landfalls. Because he was often seasick, Darwin welcomed these excursions and spent weeks away from the ship. He traveled extensively in South America and also in Australia, New Zealand, the Cocos Islands, and Mauritius.

The five-year voyage of *H.M.S. Beagle*, 1831–1836. Place names are as they appear in *The Voyage of the Beagle.*
(Adapted from The Voyage of the Beagle *(frontispiece), edited by L. Engel, 1962, New York: Doubleday.)*

In South America, Darwin saw an abundance of new species. He was nicknamed "the Philosopher" by the *Beagle's* sailors because he was always asking questions. Darwin's questions were simple yet profound; why, he wondered, had God created so many different species? He also found fossils of very large extinct animals. In a low cliff 400 miles south of Buenos Aires, Darwin found enormous fossil bones, including a massive jawbone and tooth. He concluded that it was part of the skeleton of the great antediluvian (or pre-flood) animal the *Megatherium.* Only one other specimen of this animal had been found. What had happened to all the others? Why had God allowed the gigantic armadillos whose fossils Darwin found to become extinct yet allowed much smaller armadillos to survive? Why had God allowed some species to become totally extinct? Where on Noah's ark—a vessel reportedly smaller than the *Beagle*—would there have been space for pairs of the large animals whose fossils he found? How had there been room for all the other species that survived the flood by being taken aboard the ark? And what of the age of the fossils Darwin found? James Ussher, the Archbishop of Armagh, had calculated in 1650 that the creation of the earth began at 9 P.M. on October 22, 4004 B.C., and that all creatures were created on the following six days. Fitzroy believed the date to be accurate, but both geological and fossil evidence convinced Darwin that the earth is much older.

For Darwin, the voyage's most significant event was the *Beagle's* stay on the Galápagos, a group of islands 600 miles off the coast of South America. The Galápagos were known as the Enchanted Isles because of their rugged beauty and abundant wildlife. Contemporary photographs show many of the scenes Darwin must have seen (Moore, 1980). He was especially fascinated by the giant tortoises that the islands had been named after (*galápago* is the Spanish word for saddle horse and refers to the giant carapace of the 400-pound centenary tortoise). Nicholas Lawson, the English vice governor of the Galápagos, told Darwin that he could recognize at a glance which island a tortoise came from by looking at its shell. Tortoises from islands just fifty or sixty miles apart were clearly different. Darwin himself observed fourteen species of finches on different islands. They ate different foods and had varying beaks that allowed them to eat those foods with ease. On one island, the finches had strong, thick beaks they used to crack nuts and seeds; on another island, they had smaller beaks and fed mainly on insects; and on a third island, they had beaks that allowed them to eat mainly fruits, berries and flowers. Moore's photographs of contemporary Galápagos tortoises and finches, now known as Darwin's finches, show how striking the differences are.

Darwin wondered how these differences had developed. The islands are separated by strong ocean currents and powerful winds. Perhaps living on isolated islands with different food supplies had forced individual species to change. Perhaps species are not fixed and immutable, but are able to adapt and change. The changes must have occurred slowly, over thousands of generations, but the results were clear. In these thoughts and speculations, we see the beginning of Darwin's theory of evolution with its three fundamental assumptions: that the world is not static but is ever-changing, that the process of change is slow but continuous, and that this process results in markedly differ-



The Galápagos Islands.
(The New York Times Magazine, *November 17, 2002)*

ent manifestations. Many long and difficult years would pass before Darwin finally published his theory of evolution.

Darwin's Theory of Evolution

The voyage of the *Beagle* ended in October 1836. Darwin then began the demanding task of writing the five-volume *Zoology of the Voyage of H.M.S. Beagle,* editing his journals for publication, and organizing the vast collection of specimens he had shipped back to England from all over the world. He also had time for further study and thought. During the voyage, Darwin had observed that species can adapt and change, but he was puzzled about why they did so. What was the impetus for adaptation and change? Why should species evolve? Answers began to emerge after Darwin read a review in the *Athenaeum* of *A*

Treatise on Man and the Development of his Faculties, published in 1835 by the Belgian scientist Lambert Adolphe Jacques Quetelet (1796–1874). In this book, Quetelet summarized Thomas Robert Malthus's (1766–1834) view of population growth, first published anonymously in 1798 in his *Essay on the Principle of Population as It Affects the Future Improvement of Society.* In October 1838, Darwin read Malthus's essay with its central argument based upon two postulates Malthus considered self-evident: "That food is necessary for the existence of man, and that the passion between the sexes is necessary, and will remain nearly in its present state" (Malthus, 1798, p. 11). Malthus (1798, p. 13) concluded that the unchecked growth of population is immensely greater than the power of the earth to produce subsistence, for:

> Population, when unchecked, increases in a geometric progression:
> 1–2–4–8–16–32–64–128–256 . . .
>
> while subsistence increases only in an arithmetic progression:
> 1–2–3–4–5–6–7–8–9 . . .

Malthus allowed that postponed marriage, infant mortality, epidemic, and famine might temporarily limit population growth. But inevitably, an arithmetic progression is no match for a geometric series. Thus, Malthus predicted an increasingly severe struggle for existence. Darwin wrote in his *Notebook:* "Having read Malthus on population for amusement, it at once struck me that, under these circumstances, favorable variations would tend to be preserved and unfavorable ones to be destroyed. The result would be the formation of a new species" (Darwin, Life and Letters, I, p. 83, in Simpkins, 1974, p. 69). He came to think of such ever-increasing populations and limited resources as "a force like a hundred thousand wedges trying [to] force every kind of adapted structure into gaps in the economy of nature, or rather forming gaps by thrusting out weaker ones" (Darwin, 1839, in De Beer, Rowlands, & Skramovsky, 1967, p. 129). Here, then, was an answer to the questions and puzzles of the Galápagos. Later, in *The Origin of Species,* Darwin wrote:

> Can we doubt (remembering that many more individuals are born than can possibly survive) that individuals having any advantage, however slight, over others, would have the best chance of surviving and of procreating their kind? On the other hand, we may feel sure that any variation in the least degree injurious would be rigidly destroyed. The preservation of favorable individual differences and variations, and the destruction of those which are injurious, I have called *Natural Selection* or *the Survival of the Fittest.*" (Darwin, 1859, p. 61)

Darwin's theory is both elegant and encompassing. The distinguished biologist, Thomas Huxley, after hearing it outlined, chided himself, "How extremely stupid not to have thought of that" (De Beer, 1971, p. 571). Increasing numbers of any population lead to a "struggle for existence"; in this struggle, only the fittest animals survive. Animals having characteristics that allow them to adapt to a particular environment are therefore favored and are more likely to live to pass on those characteristics to their offspring. Therefore, over many generations, species change or evolve. Darwin believed the results of natural selection to be just as marked as those of the artificial selection practiced by breeders of domestic animals and plants. By 1840, Darwin was committed to these views and even wrote an outline of the theory of evolution that he gave to his wife, instructing her to publish it in the event of his sudden death. He was, however, to delay for nearly twenty years before publishing his theory. Why did he wait so long?

One answer is that he was busy with other things. In 1838, his journal, *The Voyage of the Beagle,* was published successfully. It quickly went through two printings and a second edition in 1845. Darwin wrote in his autobiography: "The success of this my first literary child always tickles my vanity more than that of my other books" (Darwin, 1887, in Barlow, 1958, p. 116). *The Voyage of the Beagle* was a popular success because, as the editor of a modern edition said, "It is one of the greatest scientific adventure tales ever written" (Engel, 1962, p. ix). Darwin also devoted much time and effort to organizing his collection of specimens, work that was made difficult by a debilitating and mysterious illness. Darwin, who as a young man had been full of energy and vigor, now suffered constant ill health which "annihilated several years of my life" (Darwin, 1887, in Barlow, 1958, p. 122) What was the cause of his ill health? Some have speculated it was a psychosomatic manifestation of Darwin's anxiety about the consequences of publishing his theory of evolution (Colp, 1977). Saul Adler (1959) proposed another explanation. As an expert in tropical diseases, Adler recognized Darwin's symptoms as those of *Chagas's disease,* a prolonged, debilitating disease endemic to the areas of South America Darwin had visited as a young man (Engel, 1962, p. xx). In the Argentine, Darwin had been heavily bitten by Benchura beetles, 70 percent of which are vectors for the causative agent of Chagas's disease.

By the summer of 1858, Darwin was ready to present his theory in public, but one more reason for delay cropped up. Unexpectedly, in February of that year, Darwin received a letter from a British naturalist, Alfred Russel Wallace (1823–1913), asking him to look over Wallace's paper *On the Tendency of Varieties to Depart Indefinitely from the Original Type.* Wallace, too, acknowledged the influence of Malthus's essay. When Darwin read this paper, he saw that Wallace had outlined a theory of natural selection almost exactly like his own and that "it was admirably expressed and quite clear" (Darwin, 1887, in Barlow, 1958, p. 122). His first generous impulse was to withdraw and yield priority to Wallace, but Huxley, Charles Lyell (from whom Darwin had learned geology), and Joseph Hooker, the director of Kew Gardens in London, persuaded him to present his theory and Wallace's paper jointly at the July 1, 1858, meeting of the London's *Linnean Society.* This joint presentation of the theory of evolution elicited little interest. At the end of 1858, the president of the Society concluded in his annual report "that the year had not been marked by any of those striking discoveries which at once revolutionize, so to speak, the department of science on which they bear." A Professor Haughton of Dublin concluded that "all that was new in their joint presentation was false, and what was true was old" (Darwin, 1887, in Barlow, 1958, p. 122).

On November 24, 1859, Darwin published *On the Origin of Species by Means of Natural Selection, or the Preservation of Favorable Races in the Struggle for Life.* The reaction was intense; legend has it that the first printing of 1,250 copies sold out on the day of publication. In fact, all copies were ordered by booksellers anticipating a lively reaction to the book. They were correct, and Darwin's

The Great Oxford Debate on Evolution

The first major public test of Darwin's theory of evolution was at the meeting of the British Association for the Advancement of Science at Oxford in June 1860. The Sunday debate on the theory of evolution drew an audience estimated at a thousand people. Before the debate, the Bishop of Oxford, Samuel Wilberforce, nicknamed 'Soapy Sam' by his irreverent students, predicted that he would "smash Darwin." Wilberforce was a first-class controversialist and debater who also had a sense of humor. He wryly accepted the students' sobriquet ". . . since he was always in hot water and always came out of it with clean hands" (Clark, 1986, p. 154). Darwin did not attend the debate but had an able champion in Thomas Huxley. Huxley had his own nickname, "Darwin's Bulldog," due to the ferocity of his defense of science in general and evolution in particular (Desmond, 1997). Wilberforce accused Darwin of expressing sensational opinions unfounded in science and promoting heresies contrary to the Bible's divine truths. He made some effective points:

- Wilberforce was prepared to admit Darwin's theory of evolution as a working hypothesis, but not as a proven, causal explanation.
- He urged the Church and scientists such as Darwin and Huxley to find common ground.
- He asserted that whatever merits the theory might have, the gap between humans and the apes in the zoo was unbridgeable.
- He suggested that Egyptian mummies showed that humans were unchanged over thousands of years.

At the end of his presentation, Wilberforce made one of the most famous mistakes in the history of debate. He turned to Huxley and asked, "Was it through his grandfather or his grandmother that he claimed descent from a monkey?" Huxley turned to his neigh-

theory was hotly debated. Some biologists criticized his theory as a collection of unprovable and untestable hypotheses. Theologians asserted that if man and apes had a common ancestor, then man could no longer be seen as created by God in his own image. Further, if species originated through natural selection, it destroyed the ancient Galenic argument for the existence of God based upon the presence of design in nature (Chapter 1). The reaction reached a climax in a famous debate at Oxford (see box).

Continuity Darwin had made a resounding case for the continuity of species and had placed humans firmly among animals as far as physical characteristics are concerned. But what of psychological characteristics? Do we share behavioral, emotional, and cognitive characteristics with other species, or is there a discontinuity between humans and all other animals? In a later book, *The Descent of Man,* Darwin asserted that "there is no fundamental difference between man and the higher mammals in their mental faculties" (Darwin, 1871, p. 446). This topic was largely bequeathed by Darwin to his followers: George John Romanes (1848–1894), who used mainly anecdotal methods; Douglas Spalding (1840–1877), a pioneering experimentalist; and C. Lloyd Morgan (1852–1936), *The Great Oxford Debate on Evolution (Continued)*

bor and whispered, "The Lord hath delivered him into my hands." Huxley began his rebuttal by asserting that he had been unable to discern a new fact or new argument in the Bishop's presentation. As to the question of his ancestors:

> If, then, said I, the question is put to me "Would I rather have a miserable ape for a grandfather, or a man highly endowed by nature and possessed of great means and influence, and yet who employs these faculties and that influence for the mere purpose of introducing ridicule into a grave scientific discussion"—I would unhesitatingly affirm my preference for the ape." (Clark, 1986, pp. 155–156)

Others followed, including Fitzroy, now an Admiral, who rose from his seat brandishing his Bible over his head. The Bible, he declared, was the source of all truth. But Huxley and his allies had won the debate. When it was over, the undergraduates cheered, and for twenty-four hours Huxley believed himself the most popular man in Oxford. One cleric went home to tea and told his wife that the horrid Professor Huxley had shown that man was descended from the apes. "My dear," the good lady exclaimed, "do let us pray that it does not become widely known" (Montagu, 1977, p. 23). Other members of the clergy condemned Huxley and demanded an apology. Huxley refused to yield. Wilberforce believed he had won in a fair debate. He wrote this doggerel on his experience:

> . . . now a learn'd Professor, grave and wise,
> Stoutly maintains what I suppose were lies;
> And, while each listening sage in wonder
> gapes,
> Claims a proud lineage of ancestral Apes.
> Alas! cried I, if such a sage's dreams,
> Save me, ye powers, from those unhallowed
> themes;
> From self-degrading science keep me free,
> And from the pride that apes humility.
> (Desmond, 1997, p. 280)

Darwin's theory had prevailed. It now forms one of the great underpinnings of modern science (Degler, 1991).

whose *canon* or *principle of parsimony* became a critical methodological guide: "In no case may we interpret an action as the outcome of the exercise of a higher psychical faculty if it can be interpreted as the outcome of the exercise of one which stands lower in the psychological scale" (Morgan, 1896, p. 53). These three men were among the most important founders of comparative psychology, the division of psychology dealing with comparisons between different species (Dewsbury, 1984).

Mechanism Darwin was unable to explain the genetic mechanism underlying evolutionary change. Unfortunately, some of his successors seized upon Lamarck's doctrine of inheritance of acquired characteristics (Chapter 7) as the mechanism. According to this doctrine, offspring can inherit acquired characteristics, thus increasing the pace of evolutionary change. August Weismann (1834–1914) challenged Lamarckism and showed that such characteristics were not inherited. He docked the tails of hundreds of mice, but found no evidence that their offspring in later generations were born with altered tails. Weismann also focused attention on the germ plasm and chromosomes as the basis for inheritance. The research of Gregor Mendel (Chapter 11) in the latter decades of the nineteenth century demonstrated the inheritance of physical characteristics in plants. His results laid the foundation for modern genetics and provided a mechanism for the evolutionary changes Darwin had described.

Darwin's Psychology Darwin's *The Descent of Man* (1871) and *The Expression of the Emotions in Man and Animals* (1872) contain much psychological material. In *Descent of Man,* Darwin used the term *evolution* for the first time and stated openly what he had only hinted in *Origin of Species:* that humans are related to other primates. Darwin had studied facial expressions associated with different emotions in humans, including his own children and the insane (Gilman, 1979). He used photographs and even attempted to record the movements of facial muscles. His work is a clear anticipation of the contemporary research of Paul Ekman (1985). Darwin visited the London Zoo to study the apes. He was especially interested in their reactions to mirrors, again a clear anticipation of the contemporary research of Gordon Gallup (1982, 1991). Darwin had humane and progressive attitudes and beliefs. In South America, he had seen slaves and been appalled by their treatment. He had also seen the disastrous consequences of a social experiment. On one of his early voyages, Fitzroy had taken three young Fuegians from their home on *Tierra del Fuego* at the tip of South America to England to educate, Christianize, and civilize them. On the voyage of the *Beagle* these young men were returned home to spread Christianity and civilization among their people. When the *Beagle* returned a year later, only one was found. He was naked, with matted hair, and had returned to his earlier ways. Fitzroy's experiment had failed.

After reading about the mental development of a child in an article by M. Taine in the journal *Mind,* Darwin reviewed the detailed record he had kept thirty-seven years earlier of the development of his son William Erasmus Darwin (1839–1914). In July 1877, Darwin published "A Biographical Sketch of an Infant" in *Mind.* For the developmental psychologist, the book provides a rich record of observations of a child by perhaps the greatest observer of nature of all time. In the twentieth century, Darwin's example of observing his own children has been taken up by a number of observers, ranging from the animal behaviorist Jane Goodall raising her son among the chimpanzees of Africa's Gombe Reserve (Goodall, 1971) to the cognitive developmental psychologist Jean Piaget studying his children's problem solving (Piaget, 1954) and the behaviorist psychologist B. F. Skinner (Chapter 13) using operant conditioning principles in raising his daughters. Darwin was also a careful observer of his own behavior. He found his use of snuff excessive and attempted to check the habit by keeping his snuffbox in the hall of his home rather than in the study. Unhappily, this attempt was largely unsuccessful.

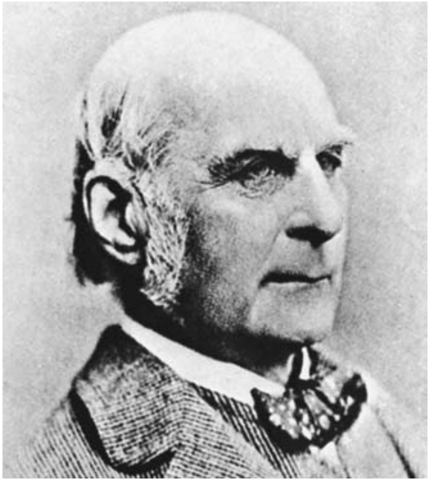
Darwin received many honors and recognitions. He was elected a fellow of the Royal Society at the age of 29, and fifty-seven foreign learned societies elected him to honorary or corresponding memberships. But he was never honored by the British government or knighted by the British sovereign; conservative and reactionary elements in the Church of England were much too powerful to allow such recognitions. Darwin died at Down House on April 19, 1882. Twenty members of Parliament petitioned the Dean of Westminster to allow his burial in Westminster Abbey. The Dean agreed, which is less incongruous than it first appears. Though Darwin thought that the word *agnostic* fitted him best, he was never bigoted or prejudiced in his views on religion and enjoyed close friendships with religious people. The Vicar of Downe, for example, was a lifelong friend of Darwin's. After Darwin's death, the Vicar erected a commemorative plaque in Darwin's honor in the graveyard of his church. Darwin was buried in Westminster Abbey, a few steps from the grave of Isaac Newton and near a commemorative plaque for Alfred Wallace. His home, Down House, is now the property of English Heritage and is open to the public. Located twenty miles south of London in the county of Kent, a short walk from the village of Downe, many of the rooms in the splendid house are furnished as they were in Darwin's time. The house also contains informative displays, selections from Darwin's collection, and beautiful gardens. No remnant of *H.M.S. Beagle* survived, and her last resting place was probably a ship's graveyard (Thompson, 1975).

Darwin's theory of evolution provided, and still provides, a framework for all the life sciences. Darwin, Freud, and Einstein are the three great "disturbers of thought" in the history of Western science. Ernst Mayr, one of the world's foremost researchers in genetic and evolutionary theory, has asserted that evolution must now be considered a fact and that there is not a single question in biology that can be answered adequately without considering evolution (Mayr, 2001). Others, such as Stephen Gould, proposed changes to the structure of evolutionary theory without challenging its centrality (Gould, 2002). For psychology, Darwin's theory of evolution raised questions about the adaptive value of consciousness and the mind's contribution to human adaptation and survival. These questions became fundamental concerns of the functionalist psychologists. An immediate expression of such concerns appears in the writings and research of the second forerunner of functionalism considered in this chapter: another nineteenth-century Englishman, and Darwin's cousin, Francis Galton.

FRANCIS GALTON (1822–1911)

Francis Galton was a man of wide interests and diverse talents who made impressive contributions to many fields of knowledge. To psychologists, Galton is best known for his development of mental tests and his research into human heredity. However, he was also a meteorologist who pioneered daily weather reports and weather maps and coined the term *anticyclone;* a student of perception who experimented with stereoscopic photographs and developed the method of composite portraiture, superimposing individual photographs to form a composite accentuating their common features; and a student of people's physical characteristics who recognized that fingerprints are unchanging and unique. (At one time, Galton had the largest collection of fingerprints in the world but did not find a single case in which all ten fingerprints from two individuals were identical; Thorwald, 1964.)[1] Galton invented an early teletype

[1] In 1880, in a letter to *Nature,* a physician named Henry Faulds who was working in Japan first suggested using fingerprints to identify criminals. In 1901, London's Scotland Yard began to do so, followed by the New York City Police Department in 1906 (Cole, 2001).



Sir Francis Galton.
(Brown Brothers)

machine; he was an anthropologist and explorer. In short, Galton pursued all knowledge with energy and enthusiasm. He wanted "to know the worst of everything as well as the very best" (Galton, quoted by Newman, 1956b, p. 1170). Galton had such a passion for science that he expected that in the future delegates to scientific meetings would join in a type of pilgrimage, united by their devotion to science and the advancement of knowledge. Galton was one of the last of the gentleman scientists who combined professionalism and amateurism (Gillham, 2001); he never held an academic appointment or directed a laboratory, and his small personal library consisted mainly of autographed copies of books by his author friends (Gridgeman, 1972, p. 266). But he did have a lively intellect and endless curiosity, so his London home at 42 Rutland Garden was a favorite meeting place for scholars and scientists.

Galton's Early Life

Galton was born in Warwickshire, near Birmingham, England's second largest city. His family was well-to-do, having made its fortune during England's industrial revolution. Galton's maternal grandfather was Erasmus Darwin. His paternal grandmother was a Barclay, from the British banking family. Galton was a precocious child who learned to read at age 2½, wrote a letter at age 4, and could read any book in the English language by age 5. Terman (Chapter 10), in his biographical studies of genius, assigned to Galton an IQ of 200. At age 4, Galton summarized his achievements in this remarkable letter to his tutor and older sister Adele:

> My dear Adele:
>
> I am 4 years old and I can read any English book, I can say all the Latin Substantives and Adjectives and active verbs besides 52 lines of Latin poetry. I can

> cast up any Sum in addition and can multiply by 2, 3, 4, 5, 6, 7, 8, ____, 10, ____. I can also say the pence table. I read French a little and I know the Clock. (Galton, in Pearson, 1914, vol. 1, p. 66)

Galton had originally written the missing numbers 9 and 11 into the sequence. Apparently realizing that he had claimed too much, he scratched out one numeral with a penknife and pasted over the other with a blank piece of paper (Fancher, 1985, p. 20). Despite all this, Raymond Fancher, the author of numerous excellent scholarly works on Galton, believes that his reputation as a prodigy and genius is "substantially exaggerated" (Fancher, 1998a, p. 102). Galton's scholastic record was undistinguished. Enrolled at the age of 8 in a brutally competitive boarding school, he did poorly with the exception of mathematics. At 16, he was placed as a medical pupil at Birmingham General Hospital. Robert Watson (1968) reported that the characteristically curious Galton tested the effects of different substances by taking them himself. His intention was to work through the pharmacopoeia from A to Z, but, understandably, he stopped at the letter C after taking croton oil, a powerful purgative. Patient deaths and *postmortem* examinations filled him with horror, so he ended his medical studies and took a general degree at Cambridge.

As an adult, Galton exemplified Virginia Woolf's maxim that independent thought is often the result of independent means. His substantial inheritance allowed him to pursue whatever interests he pleased. Galton's first professional interest was exploration. In 1845 and 1846, he traveled to Egypt, the Sudan, and Syria intending to look for the source of the Nile. In 1850, Galton visited a vast area of South West Africa (present-day Namibia). He penetrated more than a thousand miles into the interior, mapped and explored the land, and made contact with the indigenous peoples: the nomadic Bushmen living under the harsh conditions of the Kalahari Desert, the cattle-worshiping Damara, the Ovambos, and the Hottentots. Galton's first book, *Tropical South Africa,* was published in 1853. He was recognized with a gold medal from the Royal Geographical Society and his election as a Fellow of the Royal Society in 1860. Galton at times gave crude and demeaning descriptions of the people he met on his travels (Fancher, 1983), but he was unusual among nineteenth-century European explorers in that he did not feel superior to the people he met. To some of his contemporaries, native people were closer to animals than to humans. Between 1810 and 1815, a 21-year-old woman of Bushman stock named Sartje Baartman was exhibited in Paris and London as the *Hottentot Venus* (Gillham, 2001).[2] A Bushman captured on an earlier expedition was exhibited in the primate section of the London Zoo until his death at the turn of the century (Kiley, 1987). But Galton was impressed by how well the people he met had adapted to their harsh desert environment and how much better they were able to survive than he was. Galton resolved to study such human adaptations further.

After returning to England from Africa, Galton found himself "rather used up in health" (Newman, 1956b, p. 1168). In 1855, he published *Art of Travel,*

[2] In April 2002, Baartman's remains were finally returned to South Africa for honorable burial.

subtitled *Shifts and Contrivances Available in Wild Countries.* He hoped the book would help future travelers, especially soldiers in the British Army, to adapt to foreign climates. At the time, British soldiers were hopelessly ill equipped for service in the tropics with their heavy woolen red coats, so Galton's advice was sorely needed. His book was published in eight editions and became an indispensable companion of nineteenth-century travelers and explorers. It is an exhaustive collection of hints, maxims, plans, descriptions, and diagrams. Galton told the reader how to use local materials to make gunpowder, ink, louse powder, pemmican, needles, glue, and a host of other things. Much of his advice is practical, indeed. Need a nutritious sandwich? Try two slices of bread and cheese sprinkled with sultana raisins. Have to cross a deep river with a horse? Hold on to his tail and splash water in his face with the right hand to steer left and with the left hand to steer right. (This hint is illustrated with a drawing of a top-hatted gentleman crossing a stream.) Want to find honey? Catch a bee, tie a feather or straw to its leg (Galton maintains that this can be done easily), throw the bee into the air, and follow it as it flies slowly to the hive. Want to stop a donkey from braying? Lash a heavy stone to the beast's tail. Before braying, a donkey lifts its tail. If the tail is weighted down, the donkey does not bray (Middleton, 1971).

Galton's Measurements of Individual Differences

After his return to England, Galton pursued his interest in human characteristics, both physical and mental. His travels had produced a fascination with the differences between people, and he was especially intrigued by the workings or functions of the human mind. One of Galton's favorite maxims was "Whenever you can, count" (Newman, 1956b, p. 1169), and count he did. At lectures, he sat facing the audience. Galton counted the number of fidgets per minute and found that children were rarely still, middle-aged persons were medium fidgets, while elderly philosophers sometimes remained rigid for minutes at a time (Newman, 1956b, p. 1169). He made a "beauty map" of Britain in which the women of London ranked first, and those of Aberdeen, Scotland, last. Galton went to the English Derby, but rather than watching the horses, he studied changes in the prevalent tints of spectators' faces as the horses neared the finish.

To make more formal and controlled measurements, Galton established in 1884 an *anthropometric laboratory* at the International Health Exhibition in London "for the measurement in various ways of Human Form and Faculty" (Galton, quoted in Pearson, 1924, p. 359). In twelve months, he collected data on 9,337 individuals (Johnson, McClearn, Yven, Nagoshi, Ahern, & Cole, 1985, p. 875). In 1888, a similar laboratory was established in the science galleries of the South Kensington Museum. In those laboratories, the people of London could, for a fee of four pence for the first examination and three pence for second and later testings, have their physical and mental powers tested—making the labs the world's first *psychometric* clinics. Some 17,000 individuals were tested in Galton's laboratories in the 1880s and 1890s. As they left, they received an impressive-looking card showing their results. Some 7,500 individual data records still exist at the Galton Laboratory in London and have been reanalyzed (Johnson et al., 1985, p. 876). A variety of physical measurements were made—height, weight, girth, fingerprints, and head size—because Galton firmly believed that large brains and strong mental powers were accommodated by a large head, long arm span and great strength, rate of movement, visual acuity, and lung capacity. To measure mental abilities, Galton relied heavily on such physical measures as visual and auditory reaction times and the highest audible tone, since he believed that there is a consistent relationship between sensory and mental acuity. In 1888, he published a paper describing a method for quantifying this correlation. A few years later, in 1895, Galton's student Karl Pearson derived a formula that allows such relationships to be expressed mathematically as a correlation coefficient. Galton also developed a simple device, called the Galton whistle, that produced a series of whistles of different frequencies. He tested auditory acuity and found a remarkable decrease in acuity for high notes as people age. Most older people were quite unaware of this decline, and Galton took a certain delight in demonstrating it to the more haughty.

Galton also developed a series of weights arranged in a geometric series so as to produce sensations that increase arithmetically, along with a set of color, taste, and touch discrimination tests. A large proportion of the Quaker families he tested were colorblind. Galton compared men and women on these tests and concluded that men have more delicate powers of discrimination. Everyday experience, Galton suggested, confirms this conclusion:

> The tuners of pianofortes are men, and so I understand are the tasters of tea and wine, the sorters of wool and the like. These latter occupations are well-salaried, because it is of the first moment to the merchant that he should be rightly advised on the real value of what he is about to purchase or sell. If the sensitivity of women were superior to that of men, the self-interest of merchants would lead to their being almost always employed: but as the reverse is the case, the opposite supposition is likely to be the true one. (Galton, 1883, p. 30)

Galton also pointed out that most men agree that women rarely recognize a good wine or make a successful cup of tea or coffee. His conclusions and arguments were definitively sexist.

In addition to these physical tests, Galton made extensive use of questionnaires in what he termed his *psychometric studies* and *experiments.* One of his best-known studies concerned mental imagery. He asked people to recall scenes from memory—for example, the scene at the breakfast table that morning—and then to answer a series of questions about the illumination, coloring, extent, detail, reality, and persons in the scene. Most people were able to recall clear and distinct mental images, but to Galton's astonishment, he found that the great majority of scientists and mathematicians were unable to do so. Indeed, many of them thought him "fanciful" for thinking they might be able to recall such scenes. They reported that such mental imagery was as unknown to them as colors are to a blind person. Galton concluded that they had been trained to think in largely abstract terms. Others, though, were able to describe their images in minute detail, almost as if describing a scene that lay before their eyes: chess players who could play the game blindfolded, pianists who "read" a mental score while playing, orators who followed a mental text while speaking, and a Mr. Flinders Petrie, who habitually solved arithmetic problems using a mental slide rule. Petrie would "set" the slide rule's cursor to the appropriate position and then read off the answer from the scales. Such clear mental images were rare, but Galton believed that gradations of imagery are present in all people and are in general more distinct in women than in men; this was one of the few good things the generally misogynistic Galton had to say about women.

Galton also developed and used two forms of association tests. In the first, a subject was asked to respond with an association to a stimulus word. The latency of each association was a measure of the alacrity of the subject's mind. In studying the origins of individual associations, Galton found that 40 percent derived from childhood experiences, an empirical conclusion strikingly consistent with Freud's emphasis on the importance of the early years as determinants of adult behavior (Chapter 8). In his second association test, Galton simply asked the subject to allow the mind to play freely for a brief period and then to arrest and scrutinize carefully the ideas that had been present. In such a test on himself, Galton strolled along Pall Mall, one of London's most fashionable avenues, scrutinizing everything that caught his eye and examining his associations for each object (Galton, 1883, pp. 185–203). In walking 450 yards, he saw 300 objects and found that they led to numerous associations. His mental life seemed rich and diverse. A few days later, Galton repeated the walk and found to his surprise that many of the original associations recurred. He wrote:

> The actors in my mental stage were indeed very numerous, but by no means as numerous as I had imagined. They now seemed to be something like the actors in theatres where large processions are represented, who march off one side of the stage, and, going round by the back, come on again on the other. (Galton, 1883, p. 188)

Galton was intrigued by all the phenomena of the human mind, including memory. His view of memory was very much a product of the views of the *British associationists* (Chapter 2): brain elements that are simultaneously excited become liable to be thrown into a similar state of future excitement. Galton studied various techniques for improving memory: the use of concrete imagery, the formation of strings of associations, and *mnemonics.* While some people were able to use mnemonics, Galton found them confusing and not worth the mental effort.

Abnormal mental functioning, seen in its extreme in the insane, intrigued Galton, just as it had Darwin. Galton spent much time studying the inmates of a number of asylums, including the large Hanwell Asylum near London. He observed disordered sexual behaviors and described delusions and hallucinations—patients who thought that their bodies were made of glass, that their brains had melted or disappeared, or that others had taken over their souls (Galton, 1883, p. 67). Galton commented on the "gloomy segregation" (Galton, 1883, p. 67) of the insane, with each person "walking alone buried in his own thoughts" (Galton, 1883, p. 67). To better understand their mental world, Galton set out to make himself paranoid. He was so successful that after a while "every horse seemed to be watching, either with pricked ears or disguising its espionage" (Galton, 1883, p. 68). The road from sanity to insanity seemed alarmingly short. In a moving description, Galton pictured sanity as a tableland with unfenced precipices on all sides; any of us can fall over the sides at any time. The demarkation between sanity and insanity is faint.

Galton as a Hereditarian

In *Hereditary Genius,* first published in 1869, with a second edition in 1878 and an American edition in 1880, Galton reported his investigations on the relative importance of hereditary and environmental influences on our abilities and capacities. In the first sentence of the book, he stated his position in unequivocal terms: "I propose to show in this book that a man's natural abilities are derived by inheritance under exactly the same limitations as are the form and physical features of the whole organic world" (Galton, 1880, p. 1). Galton had no patience with the "fairy tale" that babies are born pretty much alike and objected "in the most unqualified manner to pretensions of natural equality" (Galton, 1880, p. 14). Humans are inherently different, and differences in such areas as mental ability are inherited and distributed on a continuum, with the frequency of each level in accordance with "the very curious theoretical law of deviation from the average" (Galton, in Newman, 1956b, p. 1181). Adolphe Quetelet, the greatest authority of the time on vital and social statistics, had proposed that law. Quetelet's aim had been to create a numerical social science, a social physics, that would bring order to social chaos (Porter, 1986). He studied the rates of birth and death and of marriage and divorce and the relationship between crime and poverty. Quetelet found order and predictability in these numbers. In a frequently quoted passage from his book *Sur l'Homme* (On Man), he concluded from his analysis of the statistics of the French criminal courts from 1826 to 1831:

> The constancy with which the same crimes repeat themselves every year with the same frequency and provoke the same punishment in the same ratios, is one of the most curious facts we learn from the statistics of the courts; I have stressed it in several papers; I have repeated every year: *There is an account paid with a terrifying regularity; that of the prisons, the galleys, and the scaffolds. This one must be reduced.* And every year the numbers confirmed my prevision in a way that I can even say: there is a tribute man pays more regularly than those owed to nature or to the Treasury; the tribute paid in crime! Sad condition of human race! We can tell beforehand how many will stain their hands with the blood of their fellow-creatures, how many will be forgers, how many poisoners, almost as one can foretell the number of births and deaths. (Quetelet, 1835, emphasis in the original, in Freudenthal, 1975, p. 237)

Quetelet also found that many physical characteristics were distributed in populations according to his law: the greater the distance from the average, the fewer the number of cases. In a regiment of 5,738 Scottish soldiers, Quetelet found an average chest size of 39.83 inches. The majority of cases clustered round the mean, with 1,073 soldiers having 39-inch chests, and 1,079 men with 40-inch chests. At the extremes were three soldiers with chests of 33 inches and one with a chest of 48 inches. As the distance from the mean increased, the number of cases decreased. Galton found that many physical and behavioral characteristics were similarly distributed: weight and height, hair color, the spread of shots around a target, and the scores of two hundred Cambridge students taking the final examinations for an honors degree. A similar distribution occurs when ten coins are tossed one thousand times and the number of *heads* recorded on each toss:

Number of Heads	Frequency
0	2
1	7
2	43
3	104
4	204
5	251
6	221
7	113
8	49
9	5
10	1

Galton was the first person to propose that mental characteristics and capacities are similarly distributed. He suggested that the distribution of a mental characteristic such as intelligence would follow what we now term a normal curve, with most people falling close to the average and larger deviations from the average becoming increasingly infrequent. The application of the normal curve model has been of central importance to many scientific and technical fields, including psychology.

Quetelet and Galton developed the concept of the "average man" as a statistical and probabilistic concept. While the physical, social, and mental characteristics of any individual are difficult to predict, the characteristics of a population are regular, and can be described statistically. Galton invented the median and percentiles as ways of expressing the central tendency and variations in the distribution of scores. This approach was not without critics. To some it was a dehumanizing and deadly type of *social physics.* Charles Dickens described people such as Quetelet and Galton who deal in nothing but figures and averages as "addled heads." But the reaction that was most important to Galton was Darwin's. He wrote to Galton in a personal letter:

> I have only read about 50 pages of your book . . . but I must exhale myself, else something will go wrong in my inside. I do not think I ever in my life read anything more interesting and original . . . I congratulate you on producing what I am convinced will be a memorable work. (Darwin, in Pearson, 1914, plate 1)

Darwin's prediction was correct, and Galton's approach has been of great importance for all the social sciences, including psychology. Galton and his

Milestones in the History of Statistics

- Pierre-Simon Laplace (1749–1827) developed probability theory and mathematical statistics (Hald, 1998).
- Carl Friedrich Gauss (1777–1855) (Chapter 7) formulated the method of least squares and methods for determining the accuracy of observations.
- Ernst Abbe (1840–1905) used goodness of fit of assumed normal distributions.
- Francis Galton introduced the following terms to statistics—*median, bell-shaped curve, correlation, dispersion, interquartile range, regression* and *percentile.*
- Karl Pearson (1857–1936), Galton's student and first biographer, and the cofounder and editor for thirty-five years of the leading statistics journal *Biometrica,* introduced the terms *histogram, kurtosis, random sampling, random walk, skewness, standard deviation* and *variate.* He also developed the formula for the product moment correlation coefficient (Johnson & Kotz, 1997).
- Graphical analysis was widely used by psychologists at the end of the nineteenth century. Thorndike (Chapter 10) published 74 learning curves in his important monograph on instrumental learning (Thorndike, 1898a); Hall (whom we will discuss in this chapter) included 25 graphs in his *Adolescence.* Hall's graphs included ". . . a number of displays that would rival the most sophisticated graphs found in science today" (Smith, Best, Cylke, & Stubbs, 2000, p. 261).
- Student, the *pseudonym* of W. S. Gosset (1876–1937), worked for the Guinness Brewery in Dublin, Ireland, on problems caused by variability in the barley and hops used to produce beer. When he published his findings, Guinness policy required that he use a *pseudonym,* thus he became "Student." He introduced small sample statistics and the Student t test.
- Ronald A. Fisher (1890–1962) developed analysis of variance, analysis techniques for small samples, the concept of the null hypothesis, and statistical significance/nonsignificance as a continuum rather than a dichotomy. ANOVAs and t tests were not introduced into psychology until the 1930s and were not widely used until the 1950s (Rucci & Tweney, 1980).

students also helped develop statistical procedures for the presentation and analysis of data.

Galton's Eminent Families

Galton gathered data on the accomplishments, honors, awards, high offices, and other marks of intellectual quality of 200 or so members of 43 families, including his own. He found high levels of intellectual achievement at above-predicted frequencies in these families. In *Hereditary Genius* (1869), Galton presented an expanded list of 977 members of 300 different families he judged to be eminent. They included judges, military commanders, literary figures, scientists, poets, musicians, painters, and academics. Since he calculated eminence to be ordinarily achieved by one person in four thousand in the normal population, Galton's families showed a disproportionate concentration of eminence. The occurrence of such high levels of achievement in certain families was for Galton definitive proof that individuals inherit such abilities. He also reported that 31 percent of the fathers in his sample were judged to be eminent, while 48 percent of their sons were so judged. Galton concluded that "genius" is hereditary and runs in certain families, and that as family closeness to an eminent person decreases, so, too, does eminence.

Criticisms of Galton's conclusions were soon forthcoming. Ironically, the most telling came from Alphonse de Candolle (1806–1893), a Swiss scientist whose family had been one of the 43 studied by Galton (Fancher, 1983). Candolle (1873) studied over 300 foreign members of the French and German Academies of Science and the British Royal Society. Election as a foreigner to those prestigious societies was considered a true mark of distinction for a scientist. In studying their backgrounds, Candolle drew up a list of favorable environmental influences. Temperate climates nurtured more scientists than did hot ones; scientists who spoke the dominant scientific languages of German, French, and English enjoyed an advantage; the absence of a dogmatic and authoritarian religious establishment dispensing preconceived notions of truth and the presence of teachers promoting a spirit of free inquiry were important favorable influences; and finally, eminent scientists tended to come from countries with relatively high standards of living offering libraries, universities, and laboratories—and people with sufficient free time to make use of them (Candolle, 1873, in Fancher, 1983, pp. 343–344).

Candolle's conclusions and his claims to have a larger and more complete set of information than Galton's prompted Galton to conduct a more extensive study. Galton's new sample consisted of 200 members of the British Royal Society, who were asked to respond to a long series of questions about their backgrounds, educations, and scientific interests. The majority agreed with Charles Darwin, who responded that his interest in science was "certainly innate." Galton summarized his findings in *English Men of Science: Their Nature and Nurture* (1874). This was Galton's first use of the phrase *nature and nurture* to describe innate versus environmental influences on development. Though Galton admitted that at times environmental influences might augment or thwart hereditary influences, he continued to insist on the supreme importance of *nature* and the dominant role of heredity as the determinant of dispositions. Galton's methodology can certainly be criticized. He relied heavily on self-reports, supplemented at times by the reports of families and friends. He paid little attention to the fact that his subjects generally came from the wealthy and aristocratic classes of England, a highly advantaged group with the best educational, occupational, and professional opportunities. He discounted these differences and attributed the performance of these men largely to their *nature.*

Nature and Nurture

In 1582, Richard Mulcaster had first used the terms *nature* and *nurture* to describe what he considered twin forces in the development of a child's mind (Teigen, 1984). By *nature,* Mulcaster meant what we now call the child's genetic inheritance, and by *nurture* all environmental conditions, including family and school. Some thirty years later, William Shakespeare used these terms in a similar way in *The Tempest* in Prospero's description of Caliban:

> A devil, a born devil, on whose nature
> Nurture can never stick; on whom my pains,
> Humanely taken, all, all lost, quite lost.
> (Act IV, Scene 1)

But it was Galton who popularized and introduced these terms to psychology, thus beginning the *nature/nurture* debate that continues to this day. In a chapter "The History of Twins, as a Criterion of the Relative Powers of Nature and Nurture" in *Inquiries into Human Faculty and Its Development* (1883), Galton proposed a *twin-study method* to assess the relative contributions of nature and nurture. His method was based on the occurrence of two different kinds of twins. *Fraternal* or *dizygotic twins* result from the separate fertilization of two ova by two sperm. They share the same genetic similarity to each other as any brothers and sisters. *Identical* or *monozygotic twins* result when a single fertilized *ovum* splits and the two halves develop into separate embryos. They are genetically identical to each other. Galton collected information from 80 to 100 twin pairs. The number is uncertain, as are the details of the methods he used to compare them. His conclusion that nature is enormously more powerful than nurture was premature, but the twin-study method he proposed has proved to be a powerful and invaluable tool.

Galton and Eugenics

Throughout his life, Galton was fascinated by the prospect of human improvement through genetic control. In 1901, he published in *Nature* a paper in which he introduced the term *eugenics,* from the Greek word *eugenes,* meaning "well-born." With the decline of Lamarckism, eugenics was seen by many as the best hope for improving the human condition. Galton argued that "the possibility of improving a race or a nation depends on the power of increasing the productivity of the best stock" (Galton, 1901, p. 663). He proposed that a systematic attempt be made to improve the nation's genetic quality by

1. encouraging marriage between a selected class of men and women;
2. encouraging earlier marriage between them; and
3. providing healthy conditions for their children, including good food and housing. (Galton, 1901, p. 664)

In 1908, Galton founded the Eugenics Society of Great Britain and the following year a monthly journal, *The Eugenics Review.* That journal published sixty volumes until it ceased publication in 1968. Galton promoted eugenics enthusiastically and left forty-five thousand pounds in his will to endow a chair of eugenics at the University of London. Degler (1991) describes the enthusiastic response to eugenics:

> On the eve of the First World War, *eugenics* was a fashionable social reform on both sides of the Atlantic. The first International Congress of Eugenics, held in London in 1912, was presided over by Leonard Darwin, one of Darwin's sons, with Winston Churchill as an English vice-president, along with the American

Twins Raised Apart/Twins Raised Together

Monozygotic (identical) and dizygotic (fraternal) twins separated early in life are a fascinating experiment provided by nature. Studies of such twins raised apart or raised together provide a powerful way to assess the relative contributions of nature and nurture to development. Twins raised apart are rare, which explains why, until recently, only a small number of such studies of modest scope appeared in the psychological literature. But more recently, two impressive long-term investigations have provided a wealth of fascinating and important information about such twins.

Since 1979, an intensive study of monozygotic and dizygotic twins, separated in infancy and raised apart, has been conducted at the Minnesota Center for Twin and Adoption Research (MICTAR) at the University of Minnesota. Thomas Bouchard, Nancy Segal, David Lykken, and their colleagues have studied more than one hundred sets of raised-apart twins or triplets (Bouchard, 1984; Bouchard, Lykken, McGue, Segal, & Tellegen, 1990; Lykken, McGue, Tellegen, & Bouchard, 1992; McGue & Bouchard, 1998). Once identified, such twins travel to Minnesota where they spend approximately fifty hours undergoing intensive psychological and physiological assessments. Two or more test instruments are used in each major psychological domain and separate examiners administer reading, writing, and spelling tests; an intelligence test; the Stroop Color Word Test; the Barron-Welsh Art Scale; and life, psychiatric, and sexual history interviews (Diagnostic Interview Schedule). In addition, each twin undergoes a comprehensive mental ability test, and a battery of physiological and medical tests including detailed medical histories, electrocardiograms, chest X rays, heart stress tests, and pulmonary exams. All of the twins were separated very early in life, raised apart during their formative years, and reunited as adults. In a small number of cases, the twins met for the first time at the Minnesota Center or did not even know they were twins until they were reunited. In their results, about 70 percent of the variance in IQ was found to be associated with genetic variation. On the multiple psychological measures of personality and temperament, occupational and leisure-time interests, and social activities, identical twins raised apart are about as similar as fraternal twins raised together. The MICTAR investigators concluded that their results show strong heritability of many psychological and physiological traits.

The researchers have also found that identical twins raised apart tend to be remarkably similar not just in appearance and aptitude, but also in their idiosyncratic habits, tastes, styles, and medical histories. Two twins were accomplished and amusing raconteurs, each with a fund of amusing anecdotes and stories; Bridget and Dorothy, 39-year-old identical twins, first met at the Minnesota Center and discovered that they each wore seven rings, two bracelets on one wrist, and a watch and a bracelet on the other wrist; they had also chosen the same names for their children. They did have different dental health histories, having been raised, re-

Twins Raised Apart/Twins Raised Together (Continued)

spectively, by upper- and working-class British families.

Some of the other similarities between the MICTAR twins are equally striking. Take the "Jim twins," as they have come to be known. Jim Springer and Jim Lewis were adopted as infants into separate working-class Ohio families. Both liked math and did not like spelling at school. Both had law enforcement training and worked part-time as deputy sheriffs. Both vacationed in Florida; both drove Chevrolets. Much has been made of the fact that their lives are marked by a trail of similar names. Both had dogs named Troy. Both married and divorced women named Linda and had second marriages with women named Betty. They named their sons James Allan and James Alan, respectively. Both like mechanical drawing and carpentry. They have almost identical drinking and smoking patterns. Both chew their fingernails down to the nubs. But what investigators thought "astounding" was their similar medical histories. In addition to having hemorrhoids and identical pulse and blood pressure and sleep patterns, both had inexplicably put on ten pounds at the same time in their lives (Holden, 1980, p. 1324). The MICTAR investigators have found such personal idiosyncracies to be surprisingly concordant among identical twins raised apart. Such results strongly suggest the importance of nature or genetic variation in human affairs. A continuing part of the Minnesota research is a longitudinal study of aging twins.

A second impressive study of twins is the Swedish Adoption/Twin Study of Aging (SATSA) conducted at the Department of Environmental Hygiene of the Karolinska Institute at Stockholm in collaboration with the Center for Developmental and Health Genetics at Pennsylvania State University (Pedersen, Plomin, Nesselroade, & McClearn, 1992). That investigation uses the same powerful methodology of identical and fraternal twins, raised apart and together:

	Identical	Fraternal
Apart	46 pairs	100 pairs
Together	67 pairs	89 pairs

The Swedish twins were much older when studied than those studied at Minnesota, having an average age of 65.6 years. They had all been separated by the age of 11, with 52 percent separated by their second birthday and 82 percent by the age of 5. The twins were tested close to their homes with a battery of cognitive and intelligence tests. Heritability of general cognitive ability in these twins was estimated to be about 80 percent, even higher than estimates for younger populations, suggesting an increased influence of genetic factors later in life. Average heritabilities for verbal, spatial, perceptual, and memory tests were 58 percent, 46 percent, 58 percent and 38 percent, respectively.

The results of these two major investigations show the power of the twin-study method Galton pioneered and also show that genetic factors, what Galton termed *nature,* are powerful influences on individual differences in a variety of psychological, physiological, and physical traits.

vice-presidents: Gifford Pinchot, the well-known conservationist, and Charles W. Eliot, the president of Harvard University. Even socialists Beatrice and Sydney Webb and Harold Laski counted themselves *eugenicists.* (Degler, 1991, p. 43)

The terrible slaughter of World War I, in which, on an average day of trench warfare on the Western Front, 2,533 men on both sides were killed, 9,121 wounded and 1,164 missing (Manchester, 1983, p. 508) was itself a horrific eugenic exercise conducted by the great powers of Europe. But as the world struggled to recover from that devastation, eugenics seemed to promise the way to a better society. During the 1920s and 1930s, eugenics was influential in England, the United States, and Germany. Eugenic ideas and proposals were part of popular culture. On one of her visits to London, Isadora Duncan (1878–1927), the beautiful American dancer who earlier had shocked society with her free-form dances in clinging and revealing costumes, made a proposal to George Bernard Shaw (1856–1950). Duncan proposed that together they could produce a baby that, according to eugenic principles, would have her body and his brain. Shaw reluctantly declined Duncan's invitation, wittily pointing out that their baby was just as likely to have *his* body and *her* brain.

At the University of London, the chair of eugenics was held from 1912 to 1933 by the eminent statistician Karl Pearson. His successor was England's leading geneticist, J. B. S. Haldane (1892–1964). Haldane wrote extensively on the relation between biology, genetics, and society (Dronamraju, 1992). In his first book, *Daedalus, or Science and the Future,* published in 1923, Haldane was enthusiastic about eugenics. He described the *eugenics official* as a combination police officer, priest, and procurer who would arrange matches between suitable members of society. But Haldane diametrically changed his mind, and his 1938 book *Heredity and Politics* was a collection of attacks on eugenics. When his successor at University College was chosen, Haldane used his influence to ensure that an opponent of eugenics, L. S. Penrose, received the appointment.

In England, class-based discrimination in education and employment was common. In the United States, segregation and sterilization of the mentally retarded and restrictive immigration laws were often "justified" as scientific eugenics (Chapter 11). In Germany, the Kaiser Wilhelm Institute for Anthropology, Human Heredity, and Eugenics was established in 1927 (Weindling, 1985) as a national eugenics institute. With the rise of the Nazis, mass deportations and murders of European Jews and gypsies were justified as necessary to preserve the purity of the "Aryan race." On January 20, 1942, fifteen senior officials of the Gestapo, government, and Nazi party, eight of whom held Ph.D.s, met in conference in a huge, gray, stucco palace overlooking a lake in the elegant Berlin suburb of Wannsee. Over a lavish lunch lubricated with cognac, they planned Hitler's "final solution to the Jewish question." Under the direction of Adolf Eichmann and S.S. Chief Reinhard Heydrich, the group reviewed the technical details of killing, liquidating, and exterminating Jews (Schmemann, 1987, p. 23; Wyden, 1992, pp. 125–128; Stein, 1988). The Wannsee Conference led directly to the deaths of 6 million people in Nazi concentration camps over the next three years. Thus, eugenics came to have the worst possible reputation. Haldane wrote:

> The appalling results of false beliefs on human genetics are exemplified in the recent history of Europe. Perhaps the most important thing which human geneticists can do for society at the moment is to emphasize how little they yet know. (Haldane, 1965, p. xci)

Haldane's warning has not always been heeded. In 1993, the official New China News Agency reported legislation "On Eugenics and Health Protection" which had been submitted to the National People's Congress. Eugenic techniques of sterilization and marriage bans were to be used in China to "avoid new births of inferior quality and heighten the standards of the whole population." The aim was to prevent the birth of as many as 10 million "inferior" people each year. With a population of 1.2 billion, or 22 percent of the world's population, the People's Congress asserted that such eugenic measures were vital to China's national interest (*Washington Post* report, *Columbus Dispatch,* December 22, 1993, p. 3A). Gregory Stock, who heads the program on medicine, technology, and society at UCLA's School of Medicine, proposed in his book *Redesigning Humans: Our Invisible Genetic Future* (2002) that we make genetic modifications to eggs, sperm, and embryos that can be passed on to future generations.

Raymond Cattell, the author or coauthor of some five hundred publications in psychology, proposed in *Beyondism* (1987) that economic incentives such as tax relief or cash payments be used to encourage the socially successful to have large families, at the same time reducing the birth rate of the poor through a yet to be invented *antiaphrodisiac* (Cattell, 1987, p. 1). Cattell's aim was to provide "a helping hand to evolution" (Jahoda, 1989, p. 816). While acknowledging past abuses of eugenics Daniel Kevles (1987) asked if *eugenics* must always be a dirty word. He argued that eugenics and the conservation of natural resources are similar propositions. Both can be practiced foolishly so as to abuse individual rights, but both can also be practiced wisely.

Galton's Inquiries into Human Faculties

In 1872, Galton published a paper entitled *Statistical Inquiries into the Efficacy of Prayer* that is remarkable not only for its controversial subject matter, but for its clear advocacy of the importance of control groups. Galton wrote:

> The principles are broad and simple. We must gather cases for statistical comparison, in which the same subject is keenly pursued by two classes similar in their physical but opposite in their spiritual state; the one class being spiritual, the other materialistic. Prudent, pious people must be compared with prudent, materialistic people. . . . We Simply look for the final result—whether those who pray attain their objects more Frequently than those who do not pray, but who live in all other respects under similar conditions. (Galton, 1872, p. 126)

The inclusion of control groups became common practice in methodologically sound research performed by the first generations of psychologists (Dehue, 2000).

In his book *Inquiries into Human Faculty and Development,* originally published in 1883 with a revised edition in 1907, Galton examined a number of different human faculties, including the faculty for prayer. Given that so many people pray, Galton asked why. Are prayers efficacious? Do they have any effect? He believed that such questions could be answered using statistical techniques. Simply stated, the question is: Are prayers answered, or are they not? Galton considered the longevity of people who were publicly prayed for and of those who were not so fortunate. The sovereigns of England were the subjects of much prayer; every English schoolchild began each school day with a prayer that God grant Queen Victoria "in health long life to live." Queen Victoria (1819–1901) died at age 81, so in her case the prayers certainly appeared to have been effective. But was this generally true? Galton cited a study by Dr. Guy, who had compared the longevity of the kings and queens of England with that of other aristocratic and upper classes of people. Dr. Guy found that the sovereigns, with an average life span of 64 years, were the shortest-lived of all these groups. Prayer had apparently not been beneficial. However, Guy also found that clergymen were second only to the country gentry in longevity. Was that because they spent so much of their time in prayer? No, said Galton, it was not, but rather was a result of "the easy country life and family repose of much of the clergy" (Galton, 1883, p. 282). Galton studied insurance claims filed with Lloyds of London by people who clearly were about God's business (missionaries) and people who clearly were not (slave traders). There was no evidence that the missionaries' voyages were safer. Insurance companies paid attention to the class of the ship and the experience of the crew, but ignored completely whether the success of the voyage was prayed for. This and similar evidence led Galton to conclude that the question of the efficacy of prayer was at best still open. To provide a definitive answer, Galton proposed that Parliament pass a law requiring all the churches of England to hold services only on alternate Sundays. By comparing the course of history and the nation's welfare on weeks which began with or without church services, a test of prayer could be made. Predictably, his proposal was never taken up. In alternate weeks, Galton prayed to an idol he mounted on his mantelpiece and ignored it completely. He found no difference in the quality of his life. Galton's proposals and studies were roundly criticized. He was accused of weakening people's faith, assailing religion, and tampering in areas where science did not belong. Such criticisms were effective, and it is significant that his chapters "Theocratic Intervention" and "Objective Efficacy of Prayer" were the only two omitted from the second edition of the *Inquiries.*

Galton's Far-Reaching Interests

Inquiries contains much information about animals, one of Galton's wide interests. He tested animal sensory acuities by walking through the streets of London and the London Zoo with a whistle hidden in his walking stick. When he sounded the whistle, dogs would turn and look around, and animals in the zoo would often come to the front of their cages. Galton's knowledge of the countryside led him to speculate about the cuckoo. Cuckoos, like cowbirds in the United States, lay their eggs in the nests of other birds, leaving their young to be reared by the host species. Why doesn't the cuckoo adopt the song and habits of its parents and nest mates? It does not, Galton answered, because the bird's heredity controls such behaviors.

For his many contributions to science, Galton was knighted Sir Francis in 1909. He died on January 17, 1911, remaining socially and professionally active until his last days. Galton was truly a Renaissance man living in the age of Queen Victoria. His hereditarian position is still important in contemporary psychology. The biographical and twin-study methods he developed are still used to investigate the relative contributions of nature and nurture to human behavior. Our focus will now move to the United States, for it was there that psychology first developed as a science and profession.

JAMES MCKEEN CATTELL (1860–1944)

We encountered Cattell in Chapter 4 as one of the first students to receive a Ph.D. degree with Wilhelm Wundt. In September 1886, Cattell was appointed to a position as a fellow-commoner at St. John's College, Cambridge. In England he met Galton, whom he would later describe as "the greatest man I have ever known" (Cattell, 1929, in Sokal, p. 222). Galton's intense interest in human capacities and behavior had great appeal to Cattell, as did his drive to observe and measure. During an earlier fellowship at Johns Hopkins University with G. Stanley Hall, Cattell studied the effects of various drugs by taking them himself, just as Galton had done at Cambridge. Until that time he had never used wines, spirits, coffee, or tobacco—his father had promised him $1,000 if he did not smoke until he was 21—and the effects were dramatic. His first cup of coffee reduced his pulse rate to forty-eight beats per minute, and as he drank a bottle of wine, his handwriting showed dramatic change. Under the influence of hashish, he wrote musical compositions apparently grander than those of Bach, and verse more beautiful than Shelley's; unhappily, the verse turned out to be

In the Spring,
The birds sing.

Cattell remained intensely curious about his own behavior and reactions throughout his life and never neglected an opportunity to collect data. In his address as President of the International Congress of Psychology (Cattell, 1929), he presented curves showing his own times walking and running a mile each day for many months, heart rate measurements after each mile of many three-mile runs, and practice curves for learning to type and to play bridge, chess, billiards, and tennis. The similarities to Galton are striking.

In 1888, Cattell returned to the United States as a professor of psychology at the University of Pennsylvania. He established a laboratory there and used Galtonian measures with students taking the laboratory course in psychology. In a paper entitled *Mental Tests and Measurements* published in 1890 in *Mind,* Cattell described the following ten tests and used the term *mental test* for the first time:

Dynamometer Pressure

Rate of Movement

Sensation-Areas

Pressure causing Pain

Psychology Finds a Home in the United States

The last decades of the nineteenth century saw developments in the United States resulting in greater educational opportunities and increased support for science and learning. One result was that American science, including psychology, began its march to the dominant position it still holds in the world. Those decades followed the catastrophe of the Civil War years, from 1861 to 1865. In *Trial by Fire: A People's History of the Civil War and Reconstruction*, Page Smith writes:

> The Civil War was an event too vast to comprehend, an event that on both sides at once rose to mythic proportions—for the South it became the "Lost Cause," the story of innocence besmirched, of chivalry betrayed; for the North the story of treason vanquished and overweening pride humbled. . . . It was a necessary war, an unnecessary war; a cleansing by fire; a war to preserve the Union; a war to free the slaves; both; neither; a corruption of the spirit; an act of aggression by the capitalist North against the agrarian South; and on and on. (Smith, 1982, p. 992)

But even during the terrible War years, the Congress of the United States enacted progressive and far-sighted legislation that changed the country forever. Menand (2001) lists some of the achievements of that wartime Congress:

> That Congress was one of the most active in American history. It supported scientific training and research; it established the first system of national taxation, and created the first significant national currency; it made possible the construction of public universities and the completion of the transcontinental railway; it turned the federal government into the legislative engine of social and economic progress. (Menand, 2001, pp. ix–x)

The legislation for public universities was passed in 1858, but President Buchanan vetoed it. More successful was an act sponsored by Senator Justin Morrill that President Lincoln signed on July 2, 1862. That legislation's goal was to make higher education available to all young people in the United States who had the desire and ability to profit

Least Noticeable Difference in Weight

Reaction-Time for Sound

Time for Naming Colours

Bi-Section of a 50-cm. Line

Judgment of 10 Seconds Time

Number of Letters Remembered on One Hearing

Cattell pointed out that "the series begins with determinations rather bodily than mental, and proceeds through psychophysical to more purely mental measurements"; these tests, Cattell asserted, would allow psychology to "attain the certainty and exactness of the physical sciences" (Cattell, 1890, p. 373).

In 1891, Cattell moved to Columbia College in New York City as a professor of experimental psychology. His salary of $2,500 per year was twice his salary at Pennsylvania (Sokal, 1981, p. 330). He established a laboratory and used his mental tests with students taking the laboratory course in psychology and gave it to 100 volunteers from each year's freshman class; this came to be known as the "Freshman Test," though it had nothing to do with admission to

Psychology Finds a Home in the United States (Continued)

from a college education. In the words of the act, it was designed

> to promote the liberal and practical education of the industrial classes primarily in the areas of agriculture and mechanics.

Grants of 30,000 acres of federal land for each member of Congress were made to the states. Proceeds from the land sales were to be invested in "safe stocks to yield not less than 5 percent." Those funds would finance the new people's universities and pay their students' fees. Not all states chose to exercise this land grant option. But in those that did, we see today universities with either the words *Agriculture and Mechanics* (A & M) or *State* in their names. Their land grant heritage is uniquely American. For their students, land grant universities were a path to a better life, to the American dream. One student recalled: "The classrooms were bare, the chairs and desks of the plainest. But as against that were the students. We knew it as a Gospel truth that this plain College was for each of us a passport to a higher and enabled life" (Jennings, 1989). Others saw research and learning as the new American frontier, one that would replace the Western frontier. In 1893, the American historian Frederick Jackson Turner proclaimed that on this new frontier, "The test tube and the microscope were needed rather than the ax and rifle" (*Time,* June 10, 1996, p. 67). The first generation of American psychologists saw themselves as working on that frontier, many of them in the recently established land grant universities. In 1929, Cattell, in his Presidential Address to the Ninth International Congress of Psychology at Yale, gave a picturesque description of psychology fifty years earlier: "In so far as psychologists are concerned, America was then like Heaven, for there was not a damned soul there" (Cattell, 1929, p. 335). In contrast, Cattell saw psychology in America in 1929 as fully populated.

the university. Cattell's tests were a culmination of attempts to assess psychological processes using physical measurements. Griesbach had made such attempts previously in Germany (Chapter 6) and Galton had done the same in England. By 1901, it was clear that this program of *anthropometric* testing had failed. The final blow was delivered by one of Cattell's students, Clark Wissler, who used Pearson's correlation techniques to measure the strength of the relationship between scores on different tests (Wissler, 1901). Wissler found almost no correlation between scores on one set of Cattell's tests and any other; he also found no correlation between a student's overall academic performance and his test scores. He and many other psychologists concluded that what was needed were psychological tests of complex mental processes. The tests developed by Alfred Binet, Lewis Terman, and many others (Chapter 11) appeared to provide such measures. They superseded Cattell's anthropometric measures, so his method of testing was abandoned.

Cattell's Other Research

In an 1895 paper published in *Science*, Cattell reported the results of experiments in which he asked students about distances on campus, the weather a week before, the dates of important historical events, and the content of a lecture given the previous week. Recall was often disconcertingly poor. In the case of the lecture, students often recalled fanciful and extraordinary material that the lecturer had not presented. Cattell concluded that our memories are often much less reliable than we think.

Cattell also conducted experimental research on judgments of relative rank. First he produced a series of 200 shades of gray, which changed in subtle steps from black to white. Students were asked to order them on the basis of brightness, and their rankings were compared with photometric brightness measurements. The students' rankings and photometric measures correlated well. Cattell then used a similar procedure to establish relative rankings of scientists. For psychologists, for example, Cattell (1903) first prepared a list of contemporary psychologists and then asked leading psychologists to rank the listed individuals. It is one thing to rank shades of gray and quite another to rank one's contemporaries. Discreetly, Cattell did not publish the psychologists' rankings until 1929, when he made them available in conjunction with his presidential address to the Ninth International Congress of Psychology (Cattell, 1929). His "top ten" psychologists in 1903 were

James

Cattell

Münsterberg

Hall

Baldwin

Titchener

Royce

Ladd

Dewey

Jastrow

Cattell published similar rankings of other scientists in *American Men of Science* (1906). In the Galtonian tradition, he also studied the family backgrounds and educations of the men he ranked. Cattell's conclusion was that a person who aimed to become a scientist had the best chance if he had a professor or a clergyman for a father; Cattell himself had both. Given such studies and his Galtonian heritage, it is no surprise that Cattell was a eugenicist. He argued forcefully for the importance of inheritance and proposed that "incentives be given to the best elements of all the people to intermarry and have large families" (Cattell, 1909, in Sokal, 1971, p. 360). Cattell had seven children and offered each of them $1,000 if they married the child of a college professor. None of his children attended public schools, but they were instead educated at home by tutors, often Cattell's graduate students, working under his supervision. All seven of Cattell's children became either scientists or science editors, with McKeen and Psyche Cattell following their father into psychology.

Psyche Cattell (1893–1989)

The life and career of Psyche Cattell provide a poignant example of the many difficulties faced by the first generation of women in psychology. In her case there is an especially sad irony in that much of her work has been credited to her father, James McKeen Cattell, or to the unrelated Raymond B. Cattell (Sokal, 1991, p. 72). After being educated at home, Psyche Cattell first worked for her father on the statistical analysis for his *American Men of Science.* After undergraduate studies at Cornell, Psyche Cattell earned Master's (1925) and Doctoral (1927) degrees in Education from Radcliffe College. In the 1920s, Psyche Cattell used data from the Harvard Growth Study to compare measures of intelligence and to follow variations in intelligence across time. Her position was that of a statistical consultant, analyzing data that others collected. In the 1930s, Cattell developed an intelligence test for infants as young as 3 months. Her test was published in 1940 and was widely used. From 1939 to 1963, Psyche Cattell worked as a staff member and then Director of the Lancaster Guidance Clinic in Lancaster, Pennsylvania. There she pioneered high-quality early childhood education. Based upon her experience in Lancaster, and as one of the first unmarried women to adopt two children, Psyche Cattell wrote *Raising Children with Love and Limits,* published in 1972. That popular book was a reaction to what she considered the permissiveness of Benjamin Spock's best-selling *Baby and Child Care.*

Despite her family lineage, her distinguished academic record, and her important contributions, Psyche Cattell never held an academic position. She was one of many women in psychology who faced discrimination and prejudice (Scarborough & Furumoto, 1987; Schiebinger, 1989).

More than fifty students took Ph.D. degrees with Cattell during his twenty-six years at Columbia University. Three of the best known were Edward Lee Thorndike, whose experiments on cats' instrumental learning and whose work in education are still widely quoted (Chapter 10); Robert S. Woodworth, a prominent experimental psychologist who succeeded Cattell as head of the Department of Psychology at Columbia (Chapter 10); and Edward K. Strong, a well-known industrial and vocational psychologist who developed the *Strong Vocational Interest Test.* Despite Cattell's reputation as a difficult, prickly, and aggressive personality (Sokal, 1971), his students were warm and appreciative in their recollections of him (Conklin et al., 1944). Woodworth, for example, remembered Cattell as a man at whose home "the latch-string seemed to be always out for his colleagues" (Woodworth, 1944b, p. 9).

The Controversial Cattell

At Columbia, Cattell was a leading advocate of faculty governance and a frequent critic of Columbia's administration, trustees, and president. He considered them autocratic and untrustworthy. His opinion of Columbia's president Nicholas Murray Butler is illustrated by the anecdote Cattell told about one of his daughters: "I once incited one of my children to call her doll Mr. President, on the esoteric grounds that he would lie in any position in which he was placed" (Sokal, 1981, p. 332). In 1917, Cattell's career at Columbia came to an abrupt end when he was dismissed from the faculty for his vehement opposition to American involvement in World War I. In May 1917, one of his sons, Owen Cattell, was arrested and convicted of distributing literature opposing conscription. In August, Cattell wrote an open letter to Congress supporting his son and protesting the government's decision to send conscripts to fight in Europe. His letter caused a storm of controversy. In announcing Cattell's dismissal and denial of his pension, President Butler of Columbia stressed that with America at war:

> What had been tolerated before becomes intolerable now. What had been wrongheaded was now sedition. What had been folly was now treason. There is and will be no place in Columbia University for any person who opposes or counsels opposition to the effective enforcement of the laws of the United States, or who acts, writes, or speaks of treason. The separation of any such person from Columbia University will be as speedy as the discovery of his offense. (P. Smith, 1985, vol. 7, p. 551)

Cattell sued the university and was awarded damages of $42,000 but was never reinstated and never again held an academic position. Rather he turned to publishing and analysis of the scientific enterprise.

Cattell as an Editor and Publisher

After his dismissal from Columbia, Cattell turned to editing and publishing. In 1894, he established with James Mark Baldwin of Princeton the *Psychological Review.* He edited the review in alternate years until 1904. Cattell also had a long association with the journal *Science.* Founded in 1880, *Science* had been supported financially by Thomas Edison and Alexander Graham Bell, but despite this auspicious backing, the magazine lost large sums of money and ceased publication in 1894 (Kohlstedt, 1980). Cattell bought the rights to the defunct magazine for $25, and in January 1895 he published the first of a "new series" of *Science.* Early in 1896, he had the good fortune to score a journalistic coup with a paper describing X rays. Wilhelm Roentgen had discovered X rays in November 1895, and a German journal article published in December of that year described them. Hugo Münsterberg wrote a description of Roentgen's discovery that Cattell published in *Science* on January 31, 1896. X rays were exciting and controversial—the eminent British physicist Lord Kelvin had predicted they would prove to be a hoax—so the first English-language description was an important paper. In 1900, Cattell forged an agreement with the American Association for the Advancement of Science (AAAS), making *Science* the official journal of the Association. Cattell agreed to provide each AAAS member with a subscription to *Science,* for which the AAAS would pay him $2. The agreement was mutually beneficial, for Cattell gained a guaranteed circulation and a source of papers for publication, while the AAAS could attract members by providing them with a subscription to *Science.* In 1944, the AAAS bought the rights to *Science* from Cattell. When the final payment was made in 1954, $270,000 had been paid to Cattell's heirs (Boffey, 1971). At one time or another, Cattell published seven journals, including *Popular Science Monthly, American Men of Science*, and *The American Naturalist*. He was psychology and science's first great publisher, promoter, and businessman.

Cattell's Involvement in Professional Affairs

Cattell was one of the founding members of the American Psychological Association (APA) in 1892; a member of the APA's council from the beginning; the association's third secretary in 1894; and its president in 1895. In 1901, Cattell was the first psychologist admitted to the National Academy of Sciences; he was president of the American Association for the Advancement of Science in 1924 and presided at the Ninth International Congress of Psychology held at New Haven in 1929. In 1921, Cattell established the Psychological Corporation to apply psychological knowledge to industry and education. The corporation was a success and is still active in marketing such psychological tests as the Wechsler Adult Intelligence Scale (WAIS), the Wechsler Intelligence Scale for Children (WISC), the Thematic Apperception Test (TAT), and the Beck Depression Scale.

Cattell died in 1944. His was a rich and diverse professional life, very different from that of his contemporary Titchener. He was an important figure in the transition from the Victorian England of Darwin and Galton to the American psychologists James and Hall. It seems appropriate to describe Cattell's life and career as truly Galtonian.

WILLIAM JAMES (1842–1910)

During the late nineteenth and early twentieth centuries, William James was widely recognized as America's foremost psychologist. In Cattell's 1903 ranking, James was the most distinguished contemporary psychologist, but even more impressive, *all* Cattell's rankers placed James first. James also had an international reputation; many in Europe regarded him as the pope of American psychology. Who was William James, and how did he come to have such a distinguished reputation?

James's Early Life

James was the child of a wealthy and cultivated Irish-American family. He was born January 11, 1842, in the Astor House, the busiest and most luxurious hotel in New York City. One of James's biographers, Gay Wilson Allen, described his early years as a "transatlantic infancy" (Allen, 1967, chapter 2). James made a trip to Europe in 1843, the first of many such journeys and tours. He attended schools in the United States, England, France, and Switzerland, encouraged by parents who took an active interest in their children's education. James was truly cosmopolitan, speaking French, German, and Italian fluently and feeling thoroughly at home anywhere in Europe. Later in life, he claimed to know every important European psychologist and philosopher.

As a young man, James met many of the great people of his time. In the United States, Ralph Waldo Emerson, Henry Thoreau, and William Thackeray, among others, visited his home; in England, Thomas Carlyle, Alfred Lord Tennyson, and John Stuart Mill (Chapter 2) were frequent visitors. James grew up in a liberal, enlightened, stimulating environment. On their many tours abroad, the James family always traveled in high style; on a trip to England they lived in a house adjoining Windsor's Great Park, next door to the Duchess of Kent and within sight of the Queen's Windsor Castle. James had three brothers and one sister, Alice, with whom he had an especially affectionate relationship. In her biography of Alice James, Jean Strouse (1980) described her as a brilliant woman whose family did not allow her to build a career as a writer. Rather, she was expected to fulfill what they saw as her destiny: to marry and have children. Alice James was unable to meet those demands. In a poignant diary entry, she asked:

> When will women begin to have the first glimmer that above all other loyalties is the loyalty to Truth, i.e. to yourself, that husband, children, friends and country are as nothing to that. (*Alice James Diary,* November 19, 1889, in Bartlett, 1992, p. 556)

Alice James had a long series of illnesses characterized by serious neurasthenic[3] symptoms and died in 1892 at the age of 44. Her death was a devastating blow to William James. Henry James, Jr., the writer, was another son in this extraordinary family. Unlike Henry, who always wanted to be a writer, William's career plans were vague. In 1861, he studied art, having shown a talent for painting and drawing from an early age. One of his fellow apprentices who went on to a successful artistic career recalled that: "James had the promise of being a remarkable, perhaps a great painter" (La Farge, 1910, p. 8). But after a few months he abandoned art, perhaps because his father did not approve of an artistic career, or perhaps because he had trouble with his eyes. Nevertheless, Leary (1992, p. 152) has argued that James's artistic sensibility and experience were critically important to the development of his psychological and philosophical thought. On April 13, 1861, Fort Sumter surrendered to the Confederate forces. President Lincoln called for seventy-five thousand volunteers to join the Union forces, but James did not respond. Instead, he enrolled in the Lawrence Scientific School at Harvard. His first major was chemistry, but James hated the subject itself and especially the associated laboratories. He switched to a general program in natural history. In 1865, James went with Louis Agassiz as an unpaid research assistant on a collecting trip to the Amazon. Agassiz was a Harvard luminary, a famed biologist, geologist, and paleontologist. The founder and director of Harvard's Museum of Comparative Zoology, Agassiz was an active proponent of the view that God had created all forms of life as separate, immutable, fixed species. He believed that the study of nature was the study of God's work and thought of himself as God's mirror on the universe (Lurie, 1989). Agassiz considered Darwin's theory of evolution to be wrong, unscientific, and sacrilegious. He described himself as a man determined to disprove Darwin. Though Agassiz was a genial professor much loved by his stu-

[3] *neurasthenia,* n. Nervous debilitation and exhaustion, as from overwork or prolonged mental strain, characterized by vague complaints of a physical nature in the absence of objective and physical causes (RHDEL, p. 960).

dents, for James the expedition was far from successful. He was terribly seasick on the voyage to South America and developed a severe stomach disorder that delayed his departure for the interior. James had to remain in Rio de Janeiro with the dull job of preserving and classifying specimens the expedition sent back. He was very homesick, and though he found the sights of Rio intoxicating, he was still more of an artist than a scientist, and his first impulse was to sketch the things he saw. When he finally joined the expedition on the Amazon, James loved the beauty and abundance of the plant and animal life and found the Brazilian Indians impressive. In a letter home, James asked: "Is it race or is it circumstances that makes these people so refined and well-bred? No gentleman of Europe has better manners, and yet these are peasants" (Menand, 2001, p. 136). But James hated Brazil's ferocious insects and debilitating climate. He also became disillusioned with Agassiz, whom he came to regard as a great teacher of scientific observation but a man with fixed and rigid views. James left the expedition in December 1865 and sailed home, convinced that the life of a systematic collector was not for him. His interests were more speculative—he characterized them as "lightweight"—but they allowed him to make major contributions to psychology and philosophy.

James returned to Harvard to study medicine. But his embrace of medicine was tepid at best:

> I embraced the medical profession a couple of months ago. My first impressions are that there is much humbug therein, and that, with the exception of surgery of which something positive is sometimes accomplished, a doctor does more by the moral effect of his presence on the patient and family, than by anything else. He also extracts money from them. (James, 1864, in Allen, 1967, p. 98)

In 1867 and 1868, James interrupted his medical studies in a way that must seem inconceivable to today's harried medical or premedical students. He read Darwin, traveled to Europe, and visited the laboratories of Fechner, von Helmholtz, Wundt, and Du Bois-Reymond. He received an M.D. degree in 1869, firmly resolved never to practice medicine—a resolution he kept for the rest of his life. As a medical student, James was plagued by numerous illnesses—back pains, eye troubles, insomnia. The drugs that were prescribed for him gave him little relief. James quoted with approval a quip by a former dean of the Harvard Medical School: "If the whole *materia medica,* excepting only opium and ether as now used, was sunk to the bottom of the sea, it would be all the better for mankind and all the worse for the fishes" (Holmes, 1853, in Allen, 1967, p. 99). James believed that his illnesses and exhausting bouts of anxiety and depression were psychological (Myers, 1986). He was far from the "adorable genius" of some depictions. At the age of 28, in 1870, James recorded a crisis in his diary and contemplated suicide. He decided to accept the view of Charles Renouvier that we have free will since we can sustain a thought because we choose to, when we might have other thoughts instead (Myers, 1986). James was later to label such assertions "pragmatic," and he found them most encouraging. He recorded in his *Diary* that he had decided to assume that he had free will in Renouvier's sense and that his first act of free will would be to believe in free will. James also resolved that for the rest of his life he would take the mind seriously.

James Enters Psychology

In 1872, James was offered a position as an instructor in physiology and anatomy at Harvard at an annual salary of $600. Melvin Maddocks described Harvard at the time as “unimaginably small and humble” (Maddocks, 1986, p. 140), but under the presidency of James’s former chemistry professor, Charles William Eliot, Harvard was about to enter its golden age. James procrastinated for a year before accepting, and then in 1874 offered his first Harvard course on the relationship between physiology and psychology. James had taken courses in physiology but not in psychology for the simple reason that none were offered at Harvard. Where, then, did he learn his psychology? From studying his own consciousness and observing the behaviors of people around him; he was self-taught. In his characteristically charming way, James once recalled that the first lecture on psychology he ever heard was the first lecture he himself gave to his students (Menand, 2001, p. 94). In 1875, James used $300 from the Harvard Corporation to set up an improvised demonstration laboratory that allowed students to observe some of the experiments he described in his lectures (Maddocks, 1986, p. 150). His courses were a success, and in 1876 James was appointed to the rank of assistant professor at a salary of $1,200 a year.

In 1882, James took a leave of absence from Harvard and traveled to Europe, renewing his contacts with many European psychologists, philosophers, and physiologists. Returning to Harvard, he was appointed a professor of philosophy in 1885 and a professor of psychology in 1889. It appears that these promotions were based almost entirely on his obvious promise and brilliant teaching reputation rather than his research contributions. However, James was well-known in Europe and in 1889 was invited to preside at the opening session of the International Congress of Psychology held in Paris. James reported after the Congress that he had been greatly encouraged by the sight of 120 men actively interested in psychology. However, his views of some of those men and of others he met in Europe were not always positive. In a letter to Stumpf (Chapter 6), James (1887) described Wundt as “the model of a German Professor” but as “the finished example of how much mere education can do for a man.” Müller he described as “brutal,” and Fechner he considered a man whose careful work in psychophysics would produce “just nothing” (James, 1890, vol. I, p. 534). In a letter to the Harvard historian George Santayana, James described Ebbinghaus as one of the Europeans’ “best,” and “the good and sharp-nosed Stumpf the most profound and philosophical of all the writers,” to whom he owed much (James, 1888, in Perry, 1935, vol. II, p. 60).

James’s *Principles of Psychology*

James’s successful teaching career at Harvard and the recognition he received in Europe increased his self-confidence and sense of well-being. But he was still unable to assert complete independence from his father. In 1876, when James was 34, his father informed him that he had just met William’s future wife, Alice Howe Gibbons, a Boston schoolteacher (Allen, 1967, p. 214). It was up to him to meet, court, and marry Miss Gibbons, which William James dutifully did in 1878. James was fortunate in his father’s choice, for his wife shared many of his interests and was untiring in her devotion to him. Some 1,400 letters from James to his wife have been published (Bjork, 1988). They show the strength of his love for Alice. Also in 1878, James signed a contract with the publisher Henry Holt for a book on psychology. James hoped to write the book in two years and began it on his honeymoon, but it actually took twelve years to complete. For James, writing was a painstaking task, requiring constant revision and reworking. In a letter to his publisher accompanying the final manuscript, James described the *Principles* and himself as: "A loathsome, distended, timified, bloated, dropsical mass, testifying to nothing but two facts: first, that there is no such thing as a science of psychology and second that W.J. is an incapable" (James, 1890, in Murphy & Kovach, 1972, p. 195). He was wrong on both counts.

Published in 1890, the two-volume, 1,393-page *Principles of Psychology* was an immediate success, and it is often cited as a classic among classics. Much of the writing seems so effortless that it is hard to remember that great emotional turmoil and sheer hard work went into the book. With an eye to a major commercial success, Henry Holt in 1892 published a 478-page abridgement entitled *Psychology: A Briefer Course.* It was a popular success. For many years, James's two books were the standard psychological texts not only in the United States but also in England, France, Italy, and Germany. They were even translated into Russian. A whole generation of psychologists learned from these books, referring to them affectionately as "the James" (*Principles*) and "the Jimmy" (*Briefer Course*) (Allport, 1961, p. xiv). Ralph Barton Perry recalled their impact:

> The *Principles of Psychology* was successful in a sense that is unusual for a book of science—it was widely read, not only by other psychologists, or by students of psychology, but by people who were under no obligation to read it. It was read because it was readable, and it was read by people of all sorts, often because of the very qualities which condemned it in the eyes of some professional psychologists. It was a tolerant, curious book; and because its author saw so wide a range of possibilities, and was so promiscuously hospitable to them, almost any later development in psychology can trace a line of ancestry there. (Perry, 1948, p. 196)

In a collection of *Reflections on the Principles of Psychology* published to mark the book's centennial (Johnson & Henley, 1990), Rand Evans described the *Principles* as "probably the most significant psychological treatise ever written in America" (Evans, 1990, p. 11). William Dember called the *Principles* "a marvel and still a source of joy and puzzlement to psychologists struggling with the core issues of our discipline" (Dember, 1992, p. 741). In 1990, the recently founded American Psychological Society devoted an issue of its flagship journal *Psychological Science* to a centennial celebration of James and the *Principles* (Estes, 1990). Peter Gray wrote in the Preface to his leading contemporary *Introductory Psychology* text:

> One of my dearest aims has been to achieve some small measure of the personal touch that William James accomplished so masterfully in the *Principles of Psychology*—the book that still stands in my mind, as far and away the best introduction to psychology ever written. (Gray, 2002, p. xv)

To such justified praise, perhaps one *caveat* should be added. Read the psychology in James, but ignore the outdated material on brain and sensory function presented in the early chapters of the book.

These two books established James as America's foremost psychologist. He was also a superb lecturer, famous for his brilliant style, striking metaphors, and lively presentation. James delighted in questions—he was one of the few Harvard professors at the time who allowed students to ask questions—and it was said that students were able to see his mind at work while he was framing his answers. One of the great joys of university teaching is following the careers and achievements of former students. One of James's most famous students was Theodore Roosevelt. James was also interested in addressing a wide audience. He developed a series of lectures for teachers which grew into his popular book *Talks to Teachers*, published in 1899. This book is practical and down-to-earth, a delightfully written collection of hints and advice for the teacher.

James was not suited by temperament or inclination to be a research worker; he was a gentleman psychologist. For him the results of laboratory investigations in psychology were simply not commensurate with the effort involved. James described Wundt's method of introspection and precise laboratory investigation as "a method which taxes patience to the utmost, and could hardly have arisen in a country whose natives could be bored." Similarly, what he termed the "brass-instrument" and "algebraic-formula filled psychology" of Fechner filled him with horror (James, 1890, vol. I, p. 549). For James, laboratory research was a psychological tool to regard with suspicion. His forte was broad thoughts and insights. Given such views, it comes as no surprise that following the success of his books James withdrew from experimental research and, as we have seen (Chapter 5), sought a successor to head the psychological laboratory at Harvard. In 1892, he chose Hugo Münsterberg, a 28-year-old German psychologist trained in orthodox introspective methodology by the master himself, Wilhelm Wundt.

James as an Eclectic

During the 1890s, James became increasingly interested in mind-body relationships and psychical phenomena. Since he had a long history of psychosomatic illness, he was interested both personally and professionally in what were called "mind cures." He took claims for such cures seriously, investigating them scientifically and even defending their advocates against orthodox medical practitioners. This, of course, did not endear him to his medical colleagues. James believed that psychologists must study the whole realm of psychological experience, including psychical experiences. He was a founding member of the American Psychical Association and president of the British Society for Psychical Research (Pate, 2000, p. 1142). James studied automatic handwriting, telepathy, clairvoyance, fortune-tellers, and a famous Boston medium, Mrs. Piper. His conclusion was that in Piper's case, some external will to communicate probably was there, but he rejected many of her claims. In searching for facts in this tremendously difficult area of psychological inquiry, James was both skeptical and open-minded. He was also interested in the effects of religious experiences on human consciousness. He defined such experiences very broadly as ones in which some sort of energy flows into consciousness. Such an energy flow could occur in both conventional and unconventional religious settings. His book *Varieties of Religious Experience* (1902) was very popular. The original publisher reprinted the book 38 times over the next 33 years. With little effort, contemporary reviewers of the work located 29 more printings from 13 other publishers (Gorsuch & Spilka, 1987, p. 773), and James's book is still used today both as a text and reference book. James was also fascinated by the possibility of life after death and promised that after death he would return to the world of the living if he could possibly manage it.

James as a Philosopher

During the last decade of his life and career, James turned away from psychology toward philosophy and established a reputation as America's best-known philosopher since Emerson. In *Pragmatism* (1907) and *The Meaning of Truth* (1909), James presented a practical, down-to-earth pragmatic philosophy he had described in a letter to Theodore Flournoy in 1907 as a "philosophy without humbug" (James, 1907, in Allen, 1967, chapter 23). This philosophy was well-suited to the spirit of the times in the United States. It has been said that, "Giraffes get longer necks—Americans get pragmatism" (Romano, 2001, p. 58). The central tenet of pragmatism is that pragmatic criteria may be applied in establishing truth. Beliefs do not work because they are true; they are true because they work. If, for a particular person, a belief in God works—that is, if it produces practical benefits in terms of happiness, personal adjustment, and psychological health—then for that person, the existence of God is a pragmatic truth. If a person believes that bathing in a particular mineral bath—something James himself did—will relieve back pain, and it does, then that is a truth for that person. However, such beliefs or truths are not absolute and should not be imposed on others. Because each person's system of beliefs must be established using pragmatic criteria, pragmatic philosophy is an individual and relative system. The pragmatist judges all beliefs by their consequences in action: the statement that John is six feet tall means nothing more than that a one-foot rule can be turned end-over-end six times alongside John; the statement can be defined operationally. James believed that pragmatic criteria can resolve the seemingly eternal clash between rationalism and empiricism. James believed rationalists to be intellectual, idealistic, optimistic, religious, free-willed—in summary, "tender-minded," and empiricists to be sensationalistic, naturalistic, pessimistic, irreligious, fatalistic—in summary, "tough-minded." James is describing a personality typology. Typologies such as introversion/extroversion, dominant/submissive, and liberal/authoritarian, with their descriptions of ideal personality types, have been common in psychological studies of personality. However, no other psychologists have come up with such a perfect summary description as James's "tender-" and "tough-minded" characterizations.

As we have seen, the work that established James's reputation was the *Principles,* and it is to that book that we turn in considering his specific contributions to the development of psychology.

James as a Psychologist

James defined psychology as "the science of Mental Life, both of its phenomena and their conditions" (James, 1890, vol. I, p. 1). Those phenomena included feelings, desires, cognitions, habits, memories, reasoning, and decisions. James studied them by informal introspective analysis of his own conscious experience. James opposed the Wundt-Titchener approach to the study of consciousness; he outlined his objections in a forceful and convincing paper entitled *Some Omissions of Introspective Psychology* (James, 1884). According to James, Wundt and Titchener assumed consciousness to be a synthesis of basic elements and so searched for its elements. James believed that this structuralist approach was unnecessarily restrictive, sterile, and artificial. It robbed psychology of most of the phenomena of consciousness James found important and interesting. James compared the structuralists' approach to that of a person who assumes that a house is a synthesis or agglutination of bricks and sets out to learn about the house by studying each brick. As the French mathematician Jules Henri Poincare (1854–1912) asserted, a house is a heap of stones; but a heap of stones is *not* a house. James proposed an analytical approach that studies the functions of consciousness and analyzes its characteristics; that studies how the mind works rather than its structure. James's powerful critique provoked this angry response from Titchener: "James's influence both in philosophy and psychology appears to me to be getting positively unwholesome. His credulity and his appeals to emotion are surely the reverse of scientific" (Titchener, 1898 letter to Cattell, in Menand, 2001, p. 370).

For James, the outstanding feature of human consciousness is that it is adaptive; that is, it allows us to adapt and adjust to our environment. Consciousness also has a number of other characteristics (James, 1890, vol. I, p. 225):

1. It is personal. My consciousness is mine alone; it is individual, not part of a general consciousness or group mind. My thoughts are mine, and yours are yours.
2. It is ever-changing. We are constantly seeing, hearing, reasoning, willing, recollecting, and longing, so consciousness is not static but is a stream.
3. It is continuous. Consciousness is not chopped up into bits or *quanta* for the convenience of introspectionist psychologists. It is a continuous stream.
4. It is selective. We are born into a world that James described in a famous metaphor as "one great blooming, buzzing confusion" (James, 1890, vol. I. p. 488) in which "sounds, sights, touches, and pains form probably one unanalyzed bloom of confusion" (James, 1890, vol. I, p. 496). If this confusion is analyzed, consciousness becomes selective.

Given such characteristics, James believed that the structuralists' attempts to develop general laws or principles of consciousness, to freeze consciousness and find its elements, were doomed to fail.

James made another major contribution to psychology with his formulation of a theory of emotion. This theory has come to be called the James-Lange theory since the Danish physiologist Carl Lange formulated a very similar hypothesis at about the same time. James first described the theory in a paper published in 1884 in the journal *Mind.* According to this theory, the nervous system makes certain innate or reflex adjustments to external stimuli, and it is the perception of these changes that constitutes the emotion. In the presence of emotional stimulation, our heart rate increases, we breathe more rapidly, we perspire, and we label the perception of these changes "emotion." To quote

James's famous examples, we see a bear, certain physiological responses occur, and we experience fear; we lose our fortune, other changes occur, and we feel sad. James wrote:

> My theory . . . is that the bodily changes follow directly the perception of the exciting fact, and that our feeling of the same changes as they occur IS the emotion. Common-sense says, we lose our fortune, are sorry and weep; we meet a bear, are frightened and run; we are insulted by a rival, are angry and strike. The hypothesis here to be defined says that this order or sequence is incorrect, that the one mental state is not immediately induced by the other, that the bodily manifestations must first be interposed between, and that the more rational statement is that we feel sorry because we cry, angry because we strike, afraid because we tremble, and not that we cry, strike, or tremble because we are sorry, angry, or fearful as the case may be. (James, 1890, vol. II, pp. 449–450)

Physiological changes are the *mind-stuff* that constitute emotions. A direct corollary of such a view of emotion is that arousing the physiological changes associated with a particular emotion should give rise to the emotion itself, and James pointed out that this is often the case. Giving way to grief or anger makes the emotion more intense; sobbing makes sorrow more acute; we work ourselves up to a climax in a rage. On the other hand, controlling the physiological response by, for example, counting to ten in the face of provocation, or whistling to keep up our courage, in turn affects the emotions of anger and fear. In the two years preceding the formulation of his theory of emotion, James had lost both of his parents. Perhaps his awareness of his own response to those losses and the ways in which he had been able to control his grief influenced his formulation of this theory.

One way to attempt to control undesirable emotions would be to learn to control the physiological changes that accompany them, an approach many modern clinicians have adopted. Thus one might be trained to relax in the presence of a fear-eliciting situation such as taking an exam, riding in an elevator, or taking radiation treatment. If one can counter the physiological responses through relaxation, one can often overcome fear. In an even more direct approach, modern *biofeedback* techniques can be used to develop some control over these physiological changes.

James's theory of emotion was, and still is, highly regarded by psychologists, but it has been less appealing to physiologists. In 1927, Walter B. Cannon (1871–1945) cited several pieces of evidence he considered to conflict with the James-Lange theory. First, emotions continue even though awareness of internal bodily changes is reduced or even eliminated. Cannon cited the case of a woman with a broken neck who received no sensations from the viscera below her neck, yet continued to experience a full range of emotions. Second, many different emotions share a common set of visceral reactions. Where does the specificity come from? When we are angry, happy, or fearful, our heart rate speeds up, blood pressure increases, and so forth, yet these are clearly different emotional experiences. Attempts to associate discrete bodily reactions with different emotions are generally unsuccessful. Third, visceral reaction times are relatively slow, whereas emotional reactions are often immediate. How can responses in a relatively "sluggish" system cause rapid emotional responses? Finally, Cannon pointed out that when we produce visceral changes artificially—for example, by adrenaline, which causes an increased heart rate and similar responses—people report that they feel "as if" they were afraid but that the emotion is not the "real thing." While all these points are well taken, the James-Lange theory has survived. It is still presented in most introductory psychology texts, and the famous examples of seeing a bear and losing a fortune are familiar to many psychology students. Finally, some contemporary evidence supports the James-Lange theory. Paul Ekman and his colleagues elicited different emotions by constructing facial prototypes and by reliving past emotional experiences. Activity of the autonomic nervous system not only distinguished between positive and negative emotions, but also among negative emotions. Their results show surprising differentiation of autonomic responses—a differentiation that is basic to the James-Lange theory of emotion (Ekman, Levenson, & Friesen, 1983).

The most often quoted chapter of the *Principles* was undoubtedly Chapter IV of Volume 1, the chapter on habit. According to James, the nervous system has the property of plasticity and can be modified by experience. Habits are established when pathways form between nerve centers in the brain. If a habit requires a series of actions A, B, C, D, etc., "concatenated" discharges occur in the nerve centers underlying these actions, and these discharges become associated. James stressed that many well-rehearsed habits are performed in an almost reflex manner and quoted with approval the statement of the Duke of Wellington that habit is ten times nature. Thus soldiers must be drilled over and over again to obey commands. James told the story of a prankster who, seeing a discharged veteran carrying home his dinner, suddenly called out, "Attention!" The veteran instantly brought his hands down and lost his mutton and potatoes in the gutter; the habit had become second nature. The great task of all forms of education is to make the nervous system an ally instead of an enemy. For James, habit is a pervasive force of great importance:

> Thus the enormous fly-wheel of society, its most precious conservative agent. It alone is what keeps us all within the bounds of ordinance, and saves the children of fortune from the envious uprisings of the poor. It alone prevents the hardest and most repulsive walks of life from being deserted by those brought up to tread therein. It keeps the fisherman and the deckhand at sea through the winter; it holds the miner in his darkness, and nails the countryman to his log-cabin and his lonely farm through all the months of snow; it protects us from invasion by the natives of the desert and the frozen zone. It dooms us all to fight out the battle of life upon lines of our nurture or our early choice. (James, 1890, vol. I, p. 121)

James believed that most habits are formed by *nurture* early in life and that by the age of 30 in most people are "set like plaster," an ancient but effective metaphor. As we settle into new habits, we come to them with a stock of old habits that may block or facilitate the new ones. Given such a position, principles of habit formation and maintenance are of central importance for psychology. Their formulation was to be a primary concern of psychologists for many decades in the twentieth century.

James hoped that once psychologists understood how habits are formed and maintained, they would be able to apply their knowledge to the creation of a better world, a world in which people would be trained in the habit of working together to eliminate such common scourges as war, pestilence, famine, and ugliness. James presented his views in 1910 in a widely acclaimed speech in San Francisco entitled *The Moral Equivalent of War.* He recognized the appeal of war—the challenge, excitement, and camaraderie—and the value of such martial virtues as courage, loyalty, self-sacrifice, and bravery. James believed that the activities of everyday life give few outlets for those qualities. While making a living, holding a job or establishing a career, and supporting a family require courage and tenacity, they encourage few heroic qualities. James speculated that the unexpressed martial qualities accumulate like water behind a dam until they burst out in violent and destructive behavior, often in war. Given the terrible destructive power of twentieth-century war, James saw a compelling need for a "moral equivalent of war" that would provide an outlet for those impulses. He proposed that young people be drafted in service to the nation not only as soldiers but also to serve the needs of the society as a whole. Such work, he believed, would have exemplary effects for both poor and disadvantaged people, who would have the opportunity to work in dignity and learn useful skills, and for the "gilded youth of the upper classes," who would learn about society's foundations and the difficult lives of others. James described his aim in a September 1906 letter to H. G. Wells: "To cure the moral flabbiness born of the exclusive worship of the bitch-goddess success. That—with the squalid cash interpretation put on the word *success*—is our national disease" (Bartlett, 1992, p. 545).

While his speech *The Moral Equivalent of War* was the academic highlight of his time in California, James had one other memorable experience. As he was leaving Cambridge for California, a prescient colleague had joked: "I hope they'll treat you to a little bit of an earthquake while you're there. It's a pity you shouldn't have that local experience" (Charles Bakewell, quoted by P. Smith, 1985, vol. 7, p. 107). The year 1906 was the year of the great San Francisco Earthquake. On the morning of April 18, 1906, James's Palo Alto hotel room began to shake and sway, the furniture fell down, and the whole building moved. Always the psychologist, James reported:

> Here's Bakewell's earthquake after all. It went crescendo and reached fortissimo in less than half a minute, and the room was shaken like a rat by a terrier . . . it was to my mind absolutely an *entity* that had been waiting all this time holding back its activity, but at last saying, "Now, *go* it!" All the while no fear, only admiration for the way a wooden house could prove its elasticity, and glee over the vividness of the manner in which such an "abstract" idea as "earthquake" could verify itself into sensible reality. (James letter to Fanny Morse, in P. Smith, 1985, vol. 7, p. 107)

James's glee turned to horror when he traveled to San Francisco the next day and saw the devastated city consumed by fires and explosions. The streets were full of homeless people who impressed James with their order and courage. Even the criminals had been made solemn by the disaster.

In the *Principles,* James considered not only how a habit is formed, but a related question: how the habit is retained or remembered—the question of memory. James devoted a chapter of his *Principles* to memory, which he defined as "knowledge of an event or fact, of which meantime we have not been thinking, with the additional consciousness that we have thought or experienced it before" (James, 1890, vol. I, p. 648). Memory allows a previous event or fact to be restored to consciousness after a period of time and thus to be recollected, reproduced, or recalled. Memory retains some of our past experiences. James believed that events and facts leave paths—vestiges or traces—between nerve centers in the brain. When these paths are excited, a particular memory results.

James held that the strength of a person's memory depends on the quality of the structure of the brain, an innate physiological characteristic unaffected by experience. No amount of trying can improve this native capacity for memory. Experience acts to affect the number of paths underlying a particular memory; the more paths that are involved, the prompter and more secure the memory. James believed that it might be possible to improve memory by improving one's habitual methods of recording facts so as to increase the number of brain paths involved. Systematically linking facts or events together might improve memory. James further argued that such linkages might be possible with similar material but were most unlikely with dissimilar material such as, for example, English prose and chemical formulas. His views contradicted proponents of the most influential educational doctrine of the time, the *formal discipline* doctrine. According to this view, we can exercise and develop the mind to improve a general intellectual faculty that we can then use in a variety of tasks. The conflict between these different views of memory was so clear that it stimulated James to conduct research on the effects of memorizing one type of material on one's ability to memorize a second type. First James memorized 158 lines of Victor Hugo's poem *Satyr,* finding that he could memorize it at the rate of one line every 50 seconds; next he memorized the entire first book of Milton's *Paradise Lost,* and then returned to the *Satyr* and learned an additional 158 lines. In this second memorization, his learning rate dropped to a line every 57 seconds. James attributed his difficulty to the intervening memorization of *Paradise Lost.* He persuaded a number of friends to make similar tests, and their results were similar. James did meet one clergyman who had developed a very functional ability to memorize sermons: as a young man, he had needed three days to commit an hour-long sermon to memory, then two days, then one, then half a day, and finally one slow "adhesive" reading. In general, though, James concluded that the doctrine of *formal discipline* was invalid.

Despite these contributions, James's reputation, and his acknowledged influence on the development of psychology—in 1970, a poll of one thousand APA members ranked James as the sixth most important influence on the development of psychology (Wright, 1970)—in 2002, in a ranking of the "top twentieth-century psychologists" based upon journal citations, introductory psychology citations, and a survey of 1,725 American Psychological Society members, James ranked fourteenth (Dittman, 2002, p. 29). He remains something of a paradox. James was never committed to psychology. In a letter to his brother Henry, he expressed a desire to be known as a philosopher rather than a psychologist. Allen (1967) reported that when Harvard awarded James an LL.D. degree in 1903, he feared that he would be introduced as William James, psychologist, and was greatly relieved when he was introduced as a philosopher. James did not found a school of psychology and in fact regarded the schools of others as premature, ill-considered, and harmful influences on the development of psychology. There were no Jamesians in the sense that there had been Wundtians and were later to be Freudians, Hullians, and Skinnerians.

James had a very small group of students, but their number included Leta Hollingsworth, James Angell, Edward Lee Thorndike, and Robert Woodworth. James enjoyed warm relationships with many of his undergraduate students. When Gertrude Stein took one of his courses at Radcliffe, she showed up for the final examination, but after reading the questions she wrote in her blue answer book: "Dear Professor James, I am sorry, but really I do not feel like taking an examination paper in philosophy today." Then she left, and the next day received this answer: "Dear Miss Stein, I understand perfectly how you feel. I often feel like that myself." With the reply was the highest mark James awarded (Maddocks, 1986, p. 150).

In 1890, against the admonitions of Harvard's president, James admitted Mary Whiton Calkins to his graduate program in psychology. Working under both James and Münsterberg at Harvard, Calkins conducted several independent experiments in which paired-associate items were used to investigate the effects of modality, primacy, recency, and frequency upon memory. Frequency was by far the strongest influence, but Calkins also observed other basic phenomena of memory, including the effect of distracting activities on the recency effect (Madigan & O'Hara, 1992). Calkins completed all the requirements for a Ph.D. at Harvard, outperforming all the male candidates on the qualifying examination. James, Münsterberg, and the philosopher Josiah Royce enthusiastically recommended award of the doctoral degree, but the degree was denied. Despite this disappointment, Calkins was appointed an Associate Professor at Wellesley College and a Professor in 1898. In 1902, Calkins declined the offer of a doctorate from Radcliffe College. In 1905—the year after James's second term—Calkins was elected the first woman president of the APA (Furumoto, 1979). Calkins went on to outline an influential *self-psychology* in which the subject matter of psychology was the *self,* not the study of the mind or behavior (Wentworth, 1999, p. 119). In 1930, a petition to the university from Harvard degree holders to award Calkins a Ph.D. was rejected (Madigan & O'Hara, 1992, p. 173). Discrimination and prejudice still ruled. Harvard granted its first doctoral degree to a woman in 1963 (Hightower, 2002).

James was not a research psychologist and is not remembered for any outstanding research contributions. He was active in the professional affairs of psychology and served as president of the APA in 1894 and again in 1904, but unlike G. Stanley Hall, the only other person elected president of the APA twice, he did not found any psychological institutions. James's reputation rests on his writings, especially his *Principles of Psychology.* Even with his writings, it is difficult to assess to what degree James's reputation is due to the content of his works and to what degree it is due to his brilliant writing style. As in his lectures, his metaphors and vivid examples are often remembered long after the substantive points they illustrate. The stream of consciousness; habit as the great flywheel of society; the blooming, buzzing confusion of the infant's world; the moral equivalent of war; tender-minded and tough-minded personalities—many of these vivid metaphors and phrases have become part of everyday language.

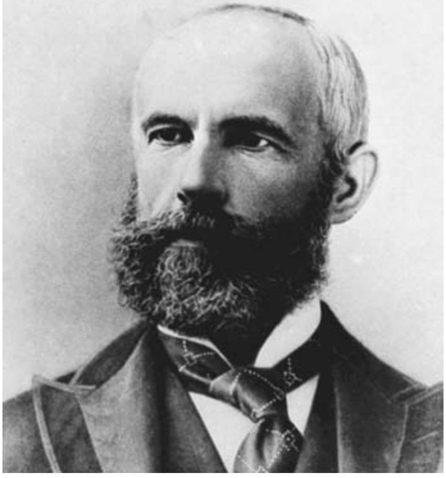
After a twelve-year struggle with a weak heart, James died of a heart attack in the summer of 1910. In one of many posthumous tributes to James, Bertrand Russell described him as "the most eminent, and probably the most widely known of contemporary philosophers" and stated that "the high value of his work on psychology is widely admitted" (Russell, 1910, cited by Allen, 1967, p. 494). Few would dispute Russell's judgment today.

GRANVILLE STANLEY HALL (1844–1924)

G. Stanley Hall was an influential pioneer in American psychology. He was James's contemporary, but the two men were very different in their backgrounds, approach, contributions, and relationships to other psychologists (Ross, 1972; Bringmann, Bringmann, & Early, 1992). Unlike the patrician James, Hall was born into a family of New England farmers. On his mother's side, he could trace his "roots" back eight generations to one of the signers of the Mayflower Compact; on his father's side, he could go back nine generations to John Hall, who left England in 1630 and settled in Massachusetts. Hall's mother was a pious, hardworking woman. She had been a schoolteacher and was intensely interested in the development of her children. For many years she kept detailed records of their progress. Perhaps one can see in his mother's interest the seed of Hall's professional interest in developmental psychology. Hall's father, who had also been a schoolteacher for ten terms in various towns, was elected to the state legislature on the "Know Nothing" ticket. He served from 1855 to 1856 but earned his living primarily as a farmer. Hall later described him as the best of fathers and a creative person who invented a machine for sowing carrots, but also as a man whose life was full of disappointments.

Hall grew up in the country, near the village of Ashfield, Massachusetts, in touch with a fascinating world of animals and plants—very different from the cosmopolitan world of James's childhood. Hall retained an interest in animals all his life, and he always made a point of exploring the zoo in any new city he

G. Stanley Hall.
(National Library of Medicine)



visited. We can imagine a cameo of James and Hall in a new city: James visits the art galleries and museums; Hall goes to the zoo. On rainy days, the young Hall would often visit Ashfield, watching the cobblers, tanners, wool carders, and saddle and basket makers at work and eavesdropping on the gossip of the old men—gossip he later described as one of the foreschools of psychology. From his Puritan family heritage, Hall derived an admiration for hard work, a belief in duty and obligation, and a powerful respect for education as a way of improving oneself.

After finishing school in 1860, Hall, at the age of 16, was employed as a village schoolteacher; he instructed a number of his former classmates, boys who were often bigger and stronger than he was. In 1862, he enrolled for one year in Williston Seminary and then at Williams College, which he attended as an undergraduate from 1863 to 1867. Hall did well at Williams, and after his graduation, he entered the Union Theological Seminary in New York City. Hall was fascinated and thrilled by the big city and spent much of his time exploring its wonders: the theaters, musical events, concerts, shows, the sights and sounds of Harlem. Hall attended a séance and even paid $5 to have his “bumps” read at Fowler and Wells’s phrenological emporium (Chapter 3). With all this activity, it is not surprising that Hall’s theological studies suffered. After preaching his trial sermon before the faculty and students of the seminary, Hall was called to the president’s study for the customary critique. When Hall entered, President Skinner knelt and prayed that Hall might be shown the true light and saved from mortal errors of doctrine. He then excused Hall without a word (Hall, 1924; Ross, 1972).

Hall’s Professional Education

In 1869, Hall left for Europe, having borrowed $1,000 to cover his expenses. He traveled widely, visiting universities and taking an occasional course, including one with the physiologist Du Bois-Reymond (Chapter 3) at the University of Berlin. Hall returned home in 1870, resumed his theological studies, and received his degree from Union Theological Seminary but was not ordained. He accepted a position at a large midwestern state university. As a last formality, the university’s president asked Hall for a letter giving details of his experience overseas and the courses he proposed to teach. When Hall replied that he planned to teach a course defending evolutionary thinking, his appointment was abruptly canceled. He was forced to earn a living as a private tutor for the wealthy Seligman family in New York City before finally securing an appointment to the faculty of Antioch College in Yellow Springs, Ohio. At that time, Antioch was a struggling Unitarian college. Hall spent four years there teaching courses on religion, rhetoric, English literature, and philosophy. In addition, he offered occasional courses to black students at the nearby Wilberforce University. During these years, Hall read the first edition of Wundt’s *Physiological Psychology* and decided to resign his position, travel to Leipzig, and study experimental psychology with Wundt.

In 1876, on his way to Europe, Hall stopped in Cambridge, Massachusetts, enrolled as a graduate student, and accepted a position as an English instructor at Harvard University. He quickly found the position involved endless recitations and grading of sophomore themes. However, he did take graduate courses with James and worked in the laboratory of the Harvard physiologist Henry Pickering Bowditch (1840–1911). Hall also worked in a small laboratory James had established "under the stairways of the Agassiz Museum" (Hall 1923, p. 218). His dissertation was on *The Perception of Space.* Hall reviewed the role of muscle cues in space perception, the classic problem George Berkeley originally addressed (Chapter 2). The dissertation was primarily based upon library research, but it did include a number of experiments. In 1878, Hall was awarded the first Ph.D. ever awarded by Harvard's philosophy department. His degree was also the first American doctoral degree on a psychological topic (Bringmann, Bringmann, & Early, 1992, p. 284).

In 1878, shortly after receiving his degree, Hall left for Leipzig. Jesse Seligman, his generous former employer, paid for the trip. At the time, Wundt's laboratory was barely organized, and Hall seems to have profited most from his contact with his fellow students, including Emil Kraepelin and Oswald Külpe (Chapter 6). He also met Gustav Fechner, at the time a very old man and almost blind but still assiduously preparing his final book on psychophysics. Hall spent his second year in Berlin working in Hermann von Helmholtz's laboratory on a number of his research projects, including the famous ones that measured the nervous impulse speed.

Hall's Early Academic Career

Hall returned to America in 1880, thoroughly familiar with German psychology but with a new bride, in debt and with no prospects of an academic appointment. Fortunately, President Eliot of Harvard asked him to give a series of twelve public lectures on education under the auspices of the university. Hall spent the summer preparing the lectures, which were a popular success. He was invited to give a similar series of lectures at the recently founded Johns Hopkins University in Baltimore. His lectures there were also a success, and Hall was offered a position as a lecturer. In 1884, he was given a five-year appointment at Johns Hopkins University as a professor of psychology and pedagogy at an annual salary of $4,000. The only opposition to his appointment came from the professor of physiology, who felt that in studying sensory functions, Hall would encroach on his department's territory; and from the professor of philosophy, who questioned Hall's teaching Aristotle and Plato in English translation.

Dan Coit Gilman, the president of Johns Hopkins, was determined to make his university an outstanding center of graduate education in the United States. He believed in the importance of research for graduate students and so established research laboratories, including one for Hall in 1883—the first formal laboratory for psychological research in the United States (Hulse & Green, 1986). Another of Gilman's innovations was the establishment of fellowships for graduate students. These fellowships attracted some excellent graduate students, including John Dewey (Chapter 10) and James McKeen Cattell. Hall, like James, saw one of his former undergraduate students, Woodrow Wilson, elected President of the United States.

Hall and the *American Journal of Psychology*

Hall was one of the great founders of psychology departments, laboratories, institutes, and journals and an organizer of American psychologists. While at Johns Hopkins, he founded the first of his journals, the *American Journal of Psychology,* through a misunderstanding. One afternoon in 1887, Hall received a call from a wealthy stranger who said that he had heard about the new department at the university and felt it should have a research journal. He gave Hall a check for $500 to start a journal and intimated that additional financial support would be forthcoming. In the journal's first number, Hall promised in the preface that "controversy as far as possible will be excluded" (Hall, 1888, p. 4), but he included a critical and skeptical critique of psychic research (Hall, 1888, pp. 128–146). From then on, no further funds were forthcoming, for spiritualism and psychic phenomena were the donor's main interests. This loss was a severe blow to Hall, who had to make up a deficit of $1,000 from his savings. The *American Journal of Psychology* was the first English-language journal to be devoted exclusively to psychology, the earlier journal *Mind* being largely philosophical. Hall's journal was open to research from all psychologists and to published papers on a wide range of topics, including the first English translations of papers on psychoanalysis by Freud and Jung. The first volume included papers on the estimation of star magnitudes, the relation of neurology to psychology, dreams, insistent and fixed ideas, the legibility of small letters, paranoia, and the winter roosting of crows. It reflected Hall's wide-ranging interests and enthusiasms. However, it was not to all psychologists' liking. Cattell described Hall's editorial work as a disgrace, and a major motive in his founding of the *Psychological Review* with James Mark Baldwin was to provide an alternative journal. Hall edited the *American Journal of Psychology* and supported it with $10,000 of his own money before selling it in 1921 to Titchener and Karl Dallenbach.

Hall and Clark University

In April 1888, Hall was surprised by an invitation to become the president of a new university to be established in Worcester, forty miles west of Boston—Clark University. This university was founded in 1887 by Jonas Gilman Clark, who, having made his fortune in California selling mining tools and equipment, had decided to establish a university modeled on Johns Hopkins in his hometown. His aim was to provide the superior university education he himself had not had. Clark's original gift was $1 million. When Hall was approached, the university had neither a campus nor a faculty. Clark commissioned Hall to visit Europe, study European universities, discuss the concept of the new university with European academicians, and recruit senior professors. Hall spread the word with great enthusiasm, visiting most of the European countries and Russia. However, Clark vetoed his attempts to recruit three European professors in the first of what was to be a long series of misunderstandings and disagreements.

Clark University opened in October 1889 with Hall as its president. The university offered five academic departments: mathematics, chemistry, biology, physics, and psychology. Clark's fortune was $20 million, but he badly underestimated the cost of founding and supporting a university. Income from student fees fell far short of expenses, since only graduate students were admitted and graduate education is always expensive. Jonas Clark found it difficult to maintain a sympathetic and supportive relationship with Hall, the faculty and students, and even the board of trustees. He withdrew from the situation, becoming secretive about his plans for the future and especially about any bequests he planned to make. Finally, the *Worcester Telegram* accused the university of cruelty to animals in experiments allegedly being conducted in the biology department. On March 9, 1890, a *Telegram* article carried seven headlines including:

Dogs Vivisected

Scientific Torture at Clark University

Helpless Animals are Killed by Inches

Cruelty is Reduced to a Fine Art

Dumb Victims Writhe Under the Cruel Knife

The Docents of Clark were accused in later articles of using "Devilish Devices" to torture animals (Dewsbury, 1990, pp. 319–320). There was not a shred of evidence to support such charges. After an official investigation by the Massachusetts Society for the Prevention of Cruelty to Animals, the university was exonerated.

A final blow fell at the end of that first terrible year when Hall caught diphtheria, went to the country to recuperate, and while there learned that his wife and child had been killed in an accident. Despite these misfortunes, the indomitable Hall carried on, but in 1892, as prospects of continued support from Jonas Clark appeared ever more dim, the faculty Hall had recruited called for his resignation. The university's trustees supported Hall, but the same year, President William Rainey Harper of the University of Chicago visited Clark University and made attractive offers to many of the faculty members, including Hall. Hall refused to join what he called a "Standard Oil institution"—a reference to the source of the University of Chicago's financial backing—but by the end of the 1892 academic year, two-thirds of the faculty members and 70 percent of the graduate students left for Chicago. In his autobiography some thirty years later, Hall's bitterness over what he called this "act of wreckage" was still clear. He compared Harper's behavior to that of a "housekeeper who steals in at the back door to engage servants" (Hall, 1924, p. 296) and termed the flight of much of the faculty "the hegira" (Hall, 1924, p. 296).

In the following years, Hall and the remaining faculty members carried on. Having been through the fire together, they were intensely loyal to the university. During the twenty-one years following Harper's raid, not a single original faculty member resigned. Undergraduates were admitted for the first time in 1902, and slowly the financial picture improved. Hall remained at Clark for thirty-one years.

Despite the chaos and uncertainties of those years, Hall was able to continue in his role as the founder of psychological institutions. In 1891, he established with his own money the *Pedagogicial Seminary,* later the *Journal of Genetic Psychology,* to publish scientific reports on children. Hall is considered the "bellwether of the child study movement" (Fagan, 1992, p. 238).

Hall and the American Psychological Association

Hall was also instrumental in founding the American Psychological Association. The first organizational meeting for the new association was held in Hall's study on July 8, 1892. The psychologists present, in addition to Hall, included Fullerton, Jastrow, James, Ladd, Cattell, and Baldwin (Fernberger, 1932, p. 2). At that meeting, twenty-six additional psychologists were invited to become charter members of the APA, including Dewey, Scripture, Witmer, Wolfe, Münsterberg, and Titchener (Fernberger, 1932, p. 4). Hall was definitely the leader. He issued the invitations, acted as host, and was, as Cattell later acknowledged, "our Socrates and midwife" (Cattell, 1929, p. 9). Annual dues were set at $3. Hall was elected the first president of the APA, and Joseph Jastrow, an active experimental psychologist, became its first secretary. The group also accepted an invitation to hold its first annual meeting at the University of Pennsylvania. The meeting was held on December 27, 1892, in the chapel, now a classroom in the department of history. The psychologists attending that first annual meeting of APA and their institutional affiliations were:

> W. H. Burnham, B. I. Gilman, E. H. Griffin, G. S Hall, W. O. Krohn, E. C. Stanford (Clark)
>
> W. James, H. Münsterberg, J. Nichols, J. Royce (Harvard)
>
> J. McKeen Cattell, J. H. Hyslop (Columbia)
>
> E. Cowles, W. Noyes (McLean Hospital)
>
> G. S. Fullteron, L. Witmer (University of Pennsylvania)
>
> J. M. Baldwin, J. G. Hume (University of Toronto)
>
> G. T. Ladd, E. W. Scripture (Yale)
>
> E. B. Delabarre (Brown)
>
> E. A. Pace (Catholic University)
>
> E. B. Titchener (Cornell)
>
> W. S. Bryan (Indiana)
>
> G. T. W. Patrick (Iowa)
>
> T. W. Mills (McGill)
>
> J. Dewey (Michigan)
>
> H. K. Wolfe (Nebraska)
>
> A. T. Ormond (Princeton)
>
> F. Angell (Stanford)
>
> J. Jastrow (Wisconsin)
>
> (Hilgard, 1987, p. 739, after Dennis & Boring, 1952)

Hall's 1892 presidential address to APA, *History and Prospects of Experimental Psychology in America,* was never published. But his enthusiasm and vigorous advocacy of psychology are clear in an article he published in 1894:

> It [psychology] is already represented in two score of the best institutions. It has already a voluminous literature; several hundred standard, new experiments. It studies the instincts of animals from the highest to the lowest. It studies the myths, customs, and beliefs of primitive man. It devotes itself to the study of sanity and nervous diseases and has already begun to introduce new methods and utilize new results. It has transformed and shaped the problems of logic and ethics; is slowly rewriting the whole history of philosophy and, in the opinion of many of its more sanguine devotees, is showing itself not only to be the long-hoped-for, long-delayed science of man, to which all other sciences are bringing their ripest and best thoughts, but is introducing a period that will be known hereafter as the psychological era of scientific thought even more than a few recent decades have been marked by evolution. (Hall, 1894, quoted by Woodworth, 1943, pp. 17–18)

At this stage of his career, Hall considered himself one of the "sanguine devotees" of psychology. With his enthusiasm, formidable organizational abilities, and compelling lecturing style, he was able to contribute much to the development of psychology.

The establishment of the APA was an important step for psychology. It marked a coming of age of the new discipline, and APA's annual meetings gave psychologists an opportunity to present and discuss their work (Evans, Staudt-Sexton, & Cadwallader, 1992). APA was also the first learned society in America to extend full membership to women (Rossiter, 1982). In 1894, Cattell nominated Christine-Ladd Franklin (Chapter 5) and Mary Whiton Calkins (this chapter) for membership, and both were elected as members of APA (Sokal, 1992, p. 115). In recent decades, the growth in the APA's membership has been spectacular as psychology developed as a science and a profession (Capshew, 1999).

Year	Members	Year	Members
1892	31	1950	9,500
1900	127	1960	19,200
1910	228	1970	30,652
1920	393	1980	50,933
1930	1,113	1990	77,545
1940	3,100	2000	83,096

(Fernberger, 1943; APA membership directories for 1950, 1960, 1970, 1980, 1990, 2000)

In 1893, the APA's budget was $63; APA's current budget is now close to $40 million. In 2000, APA's net worth was $39.5 million; due to a marked decline in revenues and the value of its investments, APA's net worth in 2001 fell to $33.3 million (Koocher, 2002).

Hall as a Developmental Psychologist

In addition to these organizational contributions to psychology, Hall did significant research and wrote a number of important books. Hall published papers on hypnotism, moral and religious training, optical illusions, and reaction-time measurements of attention. He was eclectic, a man of many and ever-changing interests. To some, however, he was a dabbler, a man with many enthusiasms but little depth, an eclectic with his feet firmly anchored in midair.

In 1883, Hall began his most valuable studies. He developed a number of questionnaires for Boston kindergarten children. The children were asked about their conceptions of nature, including animals, plants, stars, and the sun and the moon; their own bodies; their ideas of number; stories they knew and games they played; things they could do; and their notions of religion, immortality, and death. Hall tried to establish empirically the "contents of children's minds" (Hall, 1893). He found that 80 percent of these Boston children did not know what a beehive was, while 50 percent could not describe a frog.[4] Even more interesting is the narrative account Hall gave of his findings:

> Many children half-believe the doll feels cold or blows, that it pains flowers to tear or burn them, or that in summer when the tree is alive it makes it ache to pound or chop it. Children who are accounted dull in school are more apt to be imaginative and animistic. The chief field of such fond and secret childish fancies is the sky. About three-fourths of all questioned thought the world a plane, and many described it as round like a dollar, while the sky is like a flattened bowl over it. Some thought the sun went down at night into the ground or just behind certain houses, and went across, on, or under the ground to go up or out of, or off the water in the morning; but 48 percent thought that at night it goes or God takes it up higher out of sight. He takes it into heaven, and perhaps puts it to bed, and even takes off its clothes and puts them on in the morning, or again it lies under the trees, where the angels mind it. (Hall, 1893, pp. 36–37)

By 1915, Hall and his coworkers had developed 194 questionnaires on such topics as anger, play, crying and laughter, fears, humor, affection, prayer, envy, jealousy, and dreams. The questionnaires produced a wealth of information that Hall presented in his monumental 1,373-page *Adolescence* (1904). Hall was the first psychologist to describe adolescence as a distinct stage in the life cycle. His description of the *Sturm and Drang* (storm and stress) of adolescence was echoed in many later works. This book is often said to mark the formal beginning of child or developmental psychology. In 1910, Hall organized the Child Study Institute at Clark University, including a Pedagogical Museum housing a collection of objects from all over the world relating to children and child rearing.

Hall's theoretical orientation was that of a genetic psychologist, and he stressed the importance of genetics and evolution in human and animal development (Hall, 1911a). He recalled: "As soon as I heard it in my youth, I think I must have been almost hypnotized by the word *evolution,* which was music to my ears and seemed to fit my mouth better than any other" (Hall, 1924, p. 357). Hall considered psychological questions within a framework of evolutionary theory and sought an understanding of the adaptive value of behavior and consciousness. He developed a version of *recapitulation theory,* which sees the developing child as *recapitulating* the development of the human species.

[4] One of my grandsons to whom this book is dedicated, when told at the age of 3 that we were going to wash *two* cars, asked "Do we have *two* hoses?"

Storm and Stress: The Hall-Mead Imbroglio

Hall was the first psychologist, but not the first person, to describe adolescence as a turbulent time. Aristotle stated that youth "are heated by Nature as drunken men by wine." Socrates characterized youth as inclined "to contradict their parents" and "tyrannize their teachers." In the eighteenth century, Goethe and other German writers depicted the *Sturm und Drang* (storm and stress) of youth (Arnett, 1999). In *Adolescence,* Hall described adolescence as characterized by storm and stress; a developmental stage in which the young person challenges parental authority and control and is often moody and prone to reckless and antisocial behavior. Hall acknowledged the mediating effects of parental and cultural influences. He saw adolescent storm and stress as more prevalent in the United States of his time due to urbanization and the failure of home, school, and religious organizations to respond to the needs of adolescents (Arnett, 1999, p. 318).

Despite this nuanced view, Hall's critics characterized his view that the storm and stress of adolescence was both inevitable and universal. Margaret Mead, in her best-selling book *Coming of Age in Samoa* (1928), described the adolescents of the South Pacific island of Samoa as passing through adolescence without stress or turmoil. Mead reported none of the adolescent behaviors Hall described. She depicted Samoan society as relaxed, sexually free, egalitarian, and permissive. Mead attributed the storm and stress of American adolescence to cultural forces. Her book was published in sixteen languages. Since its publication, *Coming of Age in Samoa* has been required reading for college courses in Anthropology.

In 1983, Derek Freeman published *Margaret Mead and Samoa: The Making and Unmaking of an Anthropological Myth.* An Australian anthropologist, Freeman had extensive field experience on Samoa and was competent in the native language. Mead had spent eight months on the island and had at best an imperfect command of the language. Freeman asserted that Mead's account of Samoan culture and character was "fundamentally in error" (p.xii); Mead had diminished "the aggression, violence, and rivalry of Samoan life and exaggerated the degree of sexual freedom of adolescent girls" (p. 278). Freeman reported that Samoan adolescents lead lives filled with difficulties and conflicts, just as their counterparts do in Western societies. Such difficulties, argued Freeman, are rooted in biology, just as Hall had claimed.

Freeman's book ignited a furious controversy with numerous reviews, critiques, and rebuttals in both the professional literature—the *American Anthropologist* devoted a special section to the controversy (December 1983)—and in the media—the *New York Times* featured Freeman's book on its front page (January 31, 1983). Martin Orans's book *Not Even Wrong: Margaret Mead, Derek Freeman, and the Samoans* (1996) gives a comprehensive and fair review of this imbroglio. Orans evaluated Mead's contention that Samoan adolescence was less stressful than its counterpart in the United States and concluded: "Clearly, she did not have adequate data for either place to make such a claim, and her theoretical conjectures, however plausible, are a house of cards completely lacking in verification" (Orans, 1996, p. 156). Freeman (1999) further claimed that Mead was the victim of a "fateful hoax" by the Samoans.

Recapitulation theory was formulated in 1866 by Ernst Haeckel, a German anatomist. Haeckel believed that embryological development recapitulates the developmental history of the species; in Haeckel's euphonious phrase, "ontogeny recapitulates phylogeny" (K. S. Thompson, 1988). In human intrauterine development, the fetus was believed to go through stages very much like fish, reptiles, and nonprimate mammals before becoming recognizably human. Hall extended this theory to child development: a child first crawls on all fours and then walks upright. Children's play, art, and social behavior were seen as recapitulations of earlier stages of human development.

Hall wrote many articles on children and adolescents for the popular magazines of the time. Among them are the following: "How and When to Be Frank with Boys" in the *Ladies Home Journal,* 1907; "Must Your Child Lie?" in *Appleton's Magazine,* 1908; "The Boy That Your Boy Plays With" in *The Circle,* 1908; "The Awkward Age" in *Appleton's,* 1908; and "The Budding Girl" in *Appleton's,* 1909.

As Hall grew older, his interests moved to the last third of life. In 1922, he published another major work, *Senescence,* describing the psychology of the later years. Interest in aging was unusual for the time, and Hall's work was both pioneering and, for many years, unique. Children have been studied extensively by psychologists, but until very recently, older people have hardly been studied at all. Why? Possibly, as Sidney Pressey speculated, "because as adults we have all been children and so feel that we understand them; perhaps subconsciously we do not expect ever to be old, and so have less interest in older people" (Pressey, 1976, p. 7).

Hall and *Eugenics*

Given Hall's theoretical position, we should not be surprised that he was interested in *eugenics.* He was in fact an enthusiastic proponent of eugenic controls and bequeathed $300,000 to Clark University with instructions that a chair of genetic psychology be established (Rosenzweig, 1984). Hall was a firm believer in "higher" and "lower" human races (Hall, 1903, 1905a, 1905b). He believed the "Negro races" to be at an earlier stage of human development (Hall, 1906b), dependent on the "higher" white races for their development and supervision (Hall, 1911c). Hall saw it as his responsibility to educate black students, and more black psychologists received their doctorates from Hall during the early decades of this century than from any other adviser (Guthrie, 1976).

Hall's Students

Hall was the most active teacher of graduate students during the first decades of American psychology. Robert Watson (1968) reported that by 1893, eleven of the fourteen American Ph.D. degrees in psychology had been granted under Hall's supervision. By 1898, the number had increased to thirty of fifty-four. Hall was an inspirational teacher. Lewis Terman (Chapter 11) stated: "For me, Clark University meant briefly three things, freedom to work as I pleased, unlimited library facilities, and Hall's Monday evening seminar." Arnold Gesell earned his Ph.D. with Hall in 1906. He continued Hall's developmental studies and summarized them in *Infant and Child in the Culture of Today* (1943) and *The*

First Five Years of Life (1954). Hall considered the great themes of life: the influence of the childhood years, adolescence, aging, insanity, religion, sex, death, and immortality. It is not surprising that students found their studies with this brilliant, far-ranging man stimulating and memorable.

The Clark Conference

Hall also organized the first opportunity for most American psychologists to meet Sigmund Freud and hear him lecture (Evans & Koelsch, 1985). Hall had seen sexual interests in the children he studied and so was more sympathetic to Freud's views than were many of his contemporaries. He was convinced that "sex plays a leading role in life's drama" (Hall, 1924, p. 570); he had established a weekly course on sex at Clark in 1904; and in 1907, Hall was the first to propose teaching sex education in the schools (Hall, 1911b; Ross, 1972, p. 384). His lectures on sex attracted large, enthusiastic audiences, but it proved impossible to keep "outsiders" out, and so the lectures were abandoned. Hall, as he wrote in his autobiography, welcomed Freud's views:

> Human life has its night as well as its day side and the Freudian mechanisms enable us to explore the vast regions of the psychic life below the conscious surfaces. Nothing since Aristotle's categories has gone deeper or, in my opinion, is destined to have such far-reaching influence and results. (Hall, 1924, pp. 11–12)

Clark University's twentieth anniversary was to be celebrated in 1909 with a series of conferences sponsored by the university's academic departments. Hall invited two foreign *savants* to the psychology conference: Wundt, representing experimental psychology, and Freud, representing clinical psychology. In December 1908, Hall offered Wundt a fee of $750 and an honorary degree. Wundt declined, citing his age, his reluctance to travel, and his plans to participate in that year's celebration of the anniversary of the founding of the University of Leipzig. The biologist Jacques Loeb (Chapter 12) also declined, citing a prior commitment. Hall then invited Ebbinghaus, who accepted, but died in late February 1909. William Stern of Breslau finally accepted and attended the conference. Hall's first invitation to Freud included an offer of a fee of $400. Freud declined, citing the demands of his practice and the loss of professional income he would suffer by being away from Vienna at his busiest time of year. Hall reissued the invitation under the same terms offered to Wundt—$750 and the award of an honorary degree. Encouraged by Jung, who saw the conference as an opportunity to present psychoanalysis in America, Freud accepted (Evans & Koelsch, 1985).

Freud traveled to America with two of his colleagues, Sandor Ferenczi of Prague and Carl Jung of Zurich. Before boarding the ocean liner *George Washington,* the three men had lunch in Bremen. Freud fainted during the lunch—due, he said, to the wine, but perhaps also due to the anxiety Jung's presence was beginning to elicit. Their Atlantic crossing went well. Freud later recalled that he first became aware of his growing fame when he saw a cabin boy reading one of his books. Freud's party arrived in the United States on August 29, 1909. Two other psychoanalysts, A. A. Brill and Ernest Jones, met them in New York Harbor, and together they spent four days touring the city: Central Park, Chinatown, the Jewish ghetto, the Metropolitan Museum, Columbia University, and Coney Island, where they all took a ride through the tunnel of love. They then traveled to Worcester, where Freud and Jung were Hall's houseguests and the rest of the visitors stayed in a Worcester hotel. Freud and Jung found both Hall's standard of living and Clark University impressive.

The lectures given at the Clark Conference and the circumstances surrounding the visit to America have been thoroughly described by Saul Rosenzweig in *Freud, Jung, and Hall the King-Maker: The Historic Expedition to America* (*1909*) (Rosenzweig, 1992). Forty American psychologists were among the 175 people attending the conference. Hall presided and arranged the order of the lectures. Freud gave lectures on five subjects:

The origins of psychoanalysis, with special reference to the contributions of Breuer and the case of Anna O.

The failure of hypnosis as a treatment and the need for active, conscious exploration of the patient's memories and history

The use of free association, dream analysis, and the significance of such everyday phenomena as slips of the tongue

The development of sexuality, and, most controversial, the reality and importance of infant sexuality

Societal and cultural aspects of sexuality

Jung presented three lectures, two on the word association technique and one on problems in the mental life of a 4-year-old child.

The conference lectures, especially those Freud gave, were reported on and discussed in the daily papers and in an article in *The Nation* (Cromer & Anderson, 1970). Freud and his ideas received little criticism and much praise. The *Boston Transcript* reported "an enthusiastic reaction to Freud's lectures." Even the previously unremittingly hostile *Worcester Telegram* was positive; it only expressed regret that "the lectures were not given in English so that they could be taken in by more people" (Doorley, 1982, p. 75).

The audiences were eager and responsive, but Freud's views were unacceptable to some people. An eminent physician, Dr. Weir Mitchell, called Freud "a dirty, filthy man" (Doorley, 1982, p. 75). Titchener left the conference early, and a dean from the University of Toronto wrote: "An ordinary reader would gather that Freud advocates free love, removal of all restraints and a relapse into savagery" (quoted by Jones, 1955, p. 59). Others were more supportive. James was gravely ill but courageously spent one night with Hall and his guests, and attended one day's lectures. "I want to see what Freud is like," he said before the first one. Freud said of his meeting James:

> Another event at this time which made a lasting impression on me was a meeting with William James the philosopher. I shall never forget one little scene that occurred as we were on a walk together. He stopped suddenly, handed me a bag he was carrying and asked me to walk on, saying that he would catch up with me as soon as he had got through an attack of *angina pectoris* which was just coming on. He died of that disease a year later; and I have always wished that I might be as fearless as he was in the face of approaching death. (Freud, quoted by Rosenzweig, 1992, p. 171)

As the day's lectures ended, Jones remembered that "James, with his arm around my shoulder, said, 'the future of psychology belongs to your work'" (Jones, 1955, p. 57). However, James did have some reservations and wrote to a friend:

> I hope that Freud and his pupils will push their ideas to their utmost limits, so that we may learn more what they are. They can't fail to throw light on human nature, but I must confess that he made on me personally the impression of a man obsessed with fixed ideas. I can make nothing in my own case with his dream theories, and obviously "symbolism" is a most dangerous method. (James letter to Theodore Flourney, September 28, 1909, in Rosenzweig, 1992, p. 174)

At the end of the conference, the European visitors were awarded honorary degrees: Jung in education and social hygiene, and Freud a doctor of laws in psychology. The *Worcester Gazette* reported that Freud was cited as "the founder of a school of phychology [*sic*] already rich in new methods and achievements; a leader today among students of the phychology [*sic*] of sex, and of psychotherapy and analysis" (Cromer & Anderson, 1970, p. 350). Freud was deeply grateful for the recognition he had received. Freud, Jung, Ferenczi, and Brill left Worcester on September 12. They traveled to Niagara Falls before embarking for Europe on board the Kaiser Wilhelm der Grosse. Freud wrote a seven-page letter to his oldest daughter Mathilde, remarking that the whole trip had been highly interesting and very meaningful to our work, and a great success, but he was very glad that he did not have to live in America (Clark, 1980b).

Hall arranged for the conference lectures to be published in April 1910 in the *American Journal of Psychology,* thus enlarging the audience. For a number of years, Hall was an ardent supporter of Freud and an advocate of psychoanalysis. At one time, he went so far as to propose universal psychoanalysis. In *Educational Problems,* Hall said of Freud:

> [He] has brought more unity and insight into the very nature and operations of the soul, and the mechanisms of the conscience, than any other in our generation. It marks the end of the old and the dawn of a new era. It is the most triumphant vindication of the genetic mode of conceiving the mind. (Hall, 1911d, vol. I, p. 445)

Later, as was often the case with Hall, his enthusiasm for Freud cooled, but his organization of the Clark Conference was a major contribution to the development of psychology. As Dorothy Ross said in the first lines of the preface to her biography of Hall: "G. Stanley Hall is remembered best, perhaps, for bringing Sigmund Freud and Carl Gustav Jung to America in 1909 to lecture to an influential group of psychologists and scholars at Clark University" (Ross, 1972, p. xiii). On October 2, 1999, Clark University dedicated on its campus a larger-than-life bronze sculpture of Freud to commemorate his visit.

Hall's *Life and Confessions*

Toward the end of his life, Hall seems to have been a rather bitter and disenchanted man. His autobiography, *Life and Confessions of a Psychologist* (1924), is a remarkably honest and open account of his life, but it has a bitter and defensive tone. In it he described (Hall, 1924, pp. 9–21) what he considered to be impediments to the progress of psychology, including the James-Lange theory of emotion, dubbed by Hall "the sorry because we cry theory"; the classical introspectionist psychology of Titchener and mental testing (Chapter 11); psychophysics, descriptions of mind-body parallelisms or interactions, and the controversy between structuralism and functionalism, all of which he thought were absurd; and extreme behaviorism, which he also found unsatisfactory (Chapter 13). Hall was unable to accept many developments in psychology and became increasingly disenchanted with the field, but one final honor came his way. In 1924, just months before his death, he was reelected president of the APA, becoming second only to James in holding the presidency twice.

CONCLUSION

A common concern with function characterizes the men discussed in this chapter. For Darwin, different structures and behaviors allow animals to adapt to a particular environment. Through natural selection, the frequency of such structures and behaviors changes, and the species evolves. Galton extended Darwin's concepts to the study of human consciousness. He asked: How do such mental functions as memory, association formation, attention, and prayer work? What do they accomplish? Galton tried to answer these questions with careful observations inside and outside his London clinics. Cattell also studied and measured mental functions. He measured reaction times and a number of other physical responses before concluding that they did not in fact provide the measures of mental functions he sought. Another approach was needed: psychological measures or psychometric assessments of mental functions. James's recurrent concern was human consciousness. How do we remember, attend, learn, feel emotions, and have religious experiences? With such questions, James created a broader, more lively psychology and challenged restrictive approaches to consciousness. Hall pioneered studies of children, adolescents, and older people—laying the foundation for today's life-span developmental psychology. Hall was a genetic psychologist, and his fundamental questions always concerned adaptive value and significance.

Cattell and Hall founded, edited, and contributed to the first psychology journals. They were both active in the APA. The psychology departments they headed—Cattell at Columbia University and Hall at Clark University—provided an education in psychology for many students. James's *Principles of Psychology* quickly became *the* textbook of psychology. Generations of students, some of whom were stimulated to become psychologists themselves, studied this classic.

Following the theoretical approaches of Darwin and Galton, Cattell, James, and Hall established a functionalist approach to psychology in the United States. Many of their interests and research topics were taken up by the functionalist psychologists discussed in the next chapter. Through them, Cattell, James, and Hall continue to influence contemporary psychology.

Edward Thorndike.
(Brown Brothers)

CHAPTER 10

Functionalism at the University of Chicago and Columbia University

Functionalism was the first American school of psychology. *Structuralism* and *Gestalt* psychology were influential schools in the United States, but they were imports from abroad. Functionalism was American in origin, approach, and character. Unlike structuralism, with Titchener as its leader, and *Gestalt* psychology championed by Wertheimer, Koffka and Köhler, functionalism did not have a single leader or group of leaders. There is even some question as to whether functionalism was ever a formal school of psychology. But there is no doubt as to the influence and importance of the psychologists, loosely described as functionalists, presented in this chapter.

Functionalism began at the University of Chicago in America's second city. In the middle of the nineteenth century, Chicago was still a small lakeport with a population of fewer than 100,000 people. After the Civil War, Chicago's railroads, factories, and stockyards attracted so many workers that the city doubled its population each decade. By 1896, when psychologist John Dewey wrote the paper that formally marks the beginning of functionalism, Chicago's population was over a million. Carl Sandburg (1878–1967) described the city in the first verse of his mythic poem "Chicago:"

> Hog Butcher for the World,
> Tool Maker, Stacker of Wheat,
> Player with Railroads and the Nation's Freight Handler;
> Stormy, husky, brawling,
> City of the Big Shoulders. . . .
> (Sandburg, 1916, in Hallwas, 1992, *Chicago Poems*, p. 3)

Functionalism, true to the city that gave it birth, was intended to be a psychology with big shoulders: an inclusive, pragmatic, useful, American psychology. We will examine three functionalist psychologists from the University of Chicago first.

JOHN DEWEY (1859–1952)

Dewey's Early Life

John Dewey was one of America's foremost philosophers, an influential educational innovator and reformer, a social critic and commentator, and a psychologist whose writings formed the foundation of functionalism. He was born in the beautiful Vermont town of Burlington on October 20, 1859, the third of four sons in a middle-class family. Dewey grew up in a family and society that reflected the classic New England virtues: respect for personal liberty and individual rights, love of simplicity, disdain for ostentation, and dedication to democracy. Both his mother's and father's families traced their ancestry to the early New England settlers. Though he moved away from Vermont when he was a young man, Dewey remained forever a New Englander. His portraits show a craggy, flinty man who grew even more so later in life (Schilpp, 1939). Dewey lived to be 92.

Dewey's father was a grocer. A man of modest ambition, he often said that he hoped one of his boys would become a mechanic. The friendship of his customers was more important to him than their money, and no merchant in Burlington was said to have sold more goods and collected fewer bills. His wife provided the family's drive and ambition. She was determined that her sons would attend college, and all of them did.

John Dewey found his years at public school dull and tedious. He felt he discovered more with his brothers and friends on their adventures in the Vermont countryside than he learned in school. He graduated from high school at age 15 and entered the University of Vermont. There, of necessity, he received a broad education. The university had only thirteen faculty members, and he took at least one course with each of them. At Vermont, Dewey learned easily, found much of the work interesting, received good grades, and graduated *Phi Beta Kappa* in 1879. His graduating class of eighteen included one of his brothers. Dewey's mother's cousin, the principal of a high school in Pennsylvania, offered Dewey a teaching position, and Dewey taught there for two years before returning to Vermont and teaching in a Burlington high school for a year. In both schools, Dewey was required to teach all subjects. His experience convinced him of the need for educational reform. At the time there, were no national or state educational requirements or policies. Teachers were either political appointees or friends or relatives of the school authorities; they were said to "keep" rather than to "teach" school. They maintained discipline through physical force, and children were required to sit silently at their desks until the teacher called on them. Rote learning was the rule, and most teachers would not tolerate questions (Schilpp, 1939).

Dewey at Johns Hopkins University and the University of Michigan

Three years of school teaching was enough for Dewey. After hearing the plans to make Johns Hopkins an outstanding graduate university, he borrowed $500 from an aunt and traveled to Baltimore to enroll as a graduate student. Johns Hopkins was not a land-grant university (Chapter 9). In 1876, a Baltimore financier, Johns Hopkins, made a bequest of $7 million in railroad company stock to found a university in his name. He left no special instructions in his will, so the trustees and the university's first president, Daniel Coit Gilman, were free to chart their own course. They decided the university would be dedicated to research and graduate education as a center of advanced learning. It was to be independent of both church and state. That independence was affirmed when Thomas Huxley (Chapter 9) was invited to give the university's inaugural address.

At Johns Hopkins, Dewey studied philosophy and psychology, the latter under G. Stanley Hall. Two of his fellow students were Woodrow Wilson and James McKeen Cattell; Cattell held the department's only fellowship. At the end of his first year, Hall recommended termination of Cattell's appointment and the appointment of Dewey in his place. At the end of Dewey's first year, Hall recommended that Dewey, too, be denied reappointment because of his allegedly unsatisfactory work. Dewey, unlike Cattell, could not afford to leave; since he was close to attaining his degree, he carried on, writing a thesis entitled *The Psychology of Kant.* He received a Ph.D. degree with Hall as his adviser in 1884. Their relationship, however, was never close, and when Gilman suggested some years later that Dewey be invited back to Hopkins to teach philosophy, Hall vetoed the suggestion, declaring that Dewey was not competent to do so (Ross, 1972, p. 146).

Following his graduation, Dewey accepted a position as an instructor in the department of philosophy at the University of Michigan at an annual salary of $900. Dewey spent his first years at Michigan teaching courses on philosophy and psychology and writing a number of papers and books, including his *Psychology,* published in 1887. In this book, Dewey tried to blend philosophy and the new natural science of psychology, but the book was far from successful. Though the book was used at Michigan for the next ten years (Raphelson, 1973), its general use as a psychological text ended in 1890 with the publication of James's *Principles.* Dewey acknowledged the superiority of James's text and often described it as a classic.

In 1894, Dewey published one of his only empirical studies, an assessment of language development in two young children. Dewey counted relative frequencies of word usage and found that the majority of words the children used were nouns (Dewey, 1894). The subjects were not identified, but their ages and the fact that they were observed continuously for some time suggest that they were Dewey's children.

Dewey's Functionalism

In 1894, Dewey was offered the chairmanship of the department of philosophy at the University of Chicago. The university had opened in October 1892, but faculty members were still being recruited. President William Rainey Harper, with the backing of John D. Rockefeller, who eventually gave $80 million to the university, was able to offer high salaries and attractive conditions (Chapter 9).

Dewey's department of philosophy included both psychology and pedagogy.[1] From Chicago, Dewey published the paper that has become a classic in psychology and which marks the formal beginning of functionalism: "The Reflex Arc Concept in Psychology," published in the *Psychologial Review* of 1896. Influenced by Darwin, Dewey emphasized in functionalism the functions and adaptive value of mind and consciousness.

Dewey introduced his paper with a discussion of the need for a unifying principle or hypothesis in psychology. He proposed the reflex arc concept, borrowed from physiology (Chapter 3), as perhaps coming closest to meeting that need. However, his conception of the psychological reflex arc was not as a patchwork of disjointed, atomistic parts but as a coordinated unit to view as a whole. Dewey criticized stimulus-response and sensation-idea dichotomies, since they suggest distinct psychological entities rather than coordinated wholes. He stressed that responses and ideas always occur in a *functional* context and used as an illustration a child reaching for a candle flame. Both John Locke (Chapter 2) and William James (James, 1890, vol. I, p. 25) had previously used the same example. According to *structuralist* conceptions of this situation that analyze it into stimulus and response elements, the child sees the bright flame (the stimulus), reaches for it (the response), feels the burning pain (stimulus), and withdraws the hand (response). In this *elementist* analysis, behavior is considered a series of reactions to stimuli. Dewey argued that this conception is artificial in that it begins and ends at arbitrary points and ignores the role of behavioral adjustments to the environment. Before the child sees the flame, a whole series of responses must occur; after the sequence is supposedly over, many responses and other changes persist. The painful experience transforms the act of reaching for the flame, and so in the future the child will probably not respond that way. This behavioral sequence, according to Dewey, does not begin with perception of the candle or end with withdrawal of the hand. The lesson Dewey drew for psychology is that we cannot break behavior and consciousness down into parts, bits, or elements; we must understand them in terms of their role in allowing the organism to adjust to the environment. In taking this position, Dewey found himself in agreement with William James (Chapter 9) and clearly at odds with Edward Titchener (Chapter 5). The similarity between his position and that of the *Gestalt* psychologists (Chapter 7) is clear.

In addition, Dewey argued that any conception of behavior as a series of reactions to stimuli ignores one of the most important characteristics of a stimulus: it occurs in a context and is perceived by a particular individual with certain characteristics. A sudden, loud noise elicits totally different reactions from a scholar working in a library and a sentry on patrol. In the two situations, the stimulus has different "psychological value." Twenty years later, Kurt Lewin was to give similar examples in his discussion of the "life spaces" of people in different situations (Chapter 7). Dewey also pointed out that some stimuli fall below the threshold for perception by a particular person at a specific time and

[1] *pedagogy,* n. The art and science of teaching; instructional methods (RHDEL, p. 1062).

so do not affect behavior. Therefore, stimuli must be treated as psychological events, not simply as physical energies coming from the environment. In a similar vein, Dewey saw the final component of the psychological reflex arc as much more than a disjointed reaction; it, too, always occurs in a context. Thus, although Dewey's concept of the psychological reflex arc was very different from the views of the physiologists, he still argued that the model is a useful one for psychology.

Dewey's Views of Education

Dewey, influenced by Darwin's theory of evolution, described himself as a democratic evolutionist. He believed with passion that America must be an inclusive democracy. Dewey accepted Darwin's descriptions of finite, limited resources and an increasingly competitive struggle for survival, but he saw culture, education, and systems of government as differentiating the human species from all others. Schools are part of a society's culture, and Dewey believed that education is a crucial means of ensuring that people have an opportunity to function and compete to the best of their abilities in the struggle for survival. He was opposed to divine rights, inherited aristocracies, and undemocratic systems of government. All people should have an equal chance, and one way of seeing that they do is to provide equal educational and occupational opportunities for them. In his Chicago, four of five people were either foreign born or the children of immigrants. At the turn of the century, America was a land of opportunity where people of talent could thrive and make their fortunes. Andrew Carnegie, the son of a poor Scottish hand weaver, immigrated to the United States in 1848. In 1901, Carnegie was considered the richest man in the world. John D. Rockefeller, the son of a small-time businessman and peddler of cancer "cures," built Standard Oil into the "colossus of Cleveland," the largest and richest oil company in the world (Heilbroner, 1985). This was also the era of Henry Ford, Thomas Edison, the Wright brothers, and Alexander Graham Bell. Between 1910 and 1950, *per capita* gross national product doubled in America. In 1913, America produced two-thirds of the world's petroleum, more than half its copper, and over one-third of its coal. Its output of wheat, corn, and cotton was prodigious (Potter, 1954). The twentieth century promised to be the "American century," but if that promise was to be fulfilled, Dewey was convinced, educational reform was critical.

Dewey's *The School and Society* (1899) was an influential book. He saw psychology as the basis of sound educational theory and practice. To be successful, any educational system must satisfy four basic psychological needs of the child: conversation, curiosity, construction, and artistic expression. Dewey was no ivory tower theorist, but a person who believed in testing his views and theories in the rough-and-tumble of the classroom. One of the attractions of his appointment at Chicago had been the inclusion of pedagogy in the psychology department and the opportunity to work with children. Dewey was convinced that existing educational methods, particularly those used in elementary schools, were not psychologically sound. He aimed to establish a different type

Hull House: Applied Social Science

Dewey had a successful model for his school, Hull House, founded in 1889 by Jane Addams and her friend Ellen Gates Starr. Addams was a sociologist who wanted to create a laboratory to apply her philosophy of sociology. Her laboratory was not in a university, but on Halsted Street in Chicago's Nineteenth Ward, one of the most blighted urban areas in the United States. The area immediately surrounding Hull House had nine churches and 250 saloons. Chicago's economy was devastated in the last decade of the nineteenth century by:

- The June 1893 collapse of the New York stock market and the nationwide depression that followed.
- The end of the World Columbian Exposition held in Chicago to commemorate the 401st anniversary of Columbus's voyage. In the summer of 1893, 27 million visitors had come to Chicago. But when the exposition closed in October, thousands of workers lost their jobs and joined the ranks of the unemployed.
- The 1894 Pullman Strike with its associated violence and disruption.

Hull House provided some refuge from those conditions. It was modeled on Toynbee Hall, founded in London in 1884 as a "settlement"—that is, a house in an impoverished area where university men, called "settlers," lived and worked for social reform. Addams and Starr visited Toynbee House and were impressed. In Chicago, their Hull House was a refuge for young women who were often victims of abuse, a retreat from the urban environment, and a community center offering a range of programs for both children and adults. Hull Center also became an important and effective center for reform advocacy. It developed an international reputation for effective social interventions and became a regular stop for social and economic reformers from within the United States and from other countries.

Dewey lectured at Hull House and supported its programs. He regarded it, as did Addams, as an effective application of sociology. At his school, Dewey aimed to develop effective educational programs based on his philosophy of education. That philosophy was derived from psychological principles.

of school, one in which children would not be taught by rote methods but rather would be stimulated to think, to explore, and thus to learn.

In January, 1896, with the aid of a small group of Chicago parents interested in a different type of education for their children, Dewey started a "laboratory school" for sixteen children, all under the age of 12, and two teachers, under the auspices of his department. He intended the relationship between the university's department of psychology and pedagogy and this school to be similar to that between the departments of physics and chemistry and their laboratories. Dewey did not intend his laboratory school to be a teacher training school, but rather a laboratory to study how children think and learn and how to best teach them. At Chicago, the school became known as "Dewey's School." It was a success, and by 1902 enrolled 140 students, with twenty-three teachers and ten graduate student assistants. It served as a model for similar schools, often set on university campuses. Carved in stone above the entrances to the former university (Dewey) school on the campus of The Ohio State University are the admonitions:

Praise the doubt, low kinds exist without

and

A healthy mind in a healthy body

Dewey also had an international influence, serving as an adviser to the governments of China and Japan when they reorganized their school systems. As a member of the Committee for Soviet-American friendship, Dewey also studied education in Russia. After the Russian Revolution, he counseled an open mind on what he saw as the most far-reaching social experiment ever tried, only to be branded a Bolshevik. After visiting the Soviet Union, he expressed grave doubts about the direction of the Soviet experiment, and he was then branded a reactionary (Rucker, 1974, p. 275). Dewey attracted many foreign students, who carried his educational philosophy back to their native countries. Such was Dewey's prestige in China that the State Department, in 1942, asked him to write a message to be dropped from airplanes encouraging the Chinese to keep on resisting the Japanese (Martin, 2003).

Dewey was convinced that education must foster growth, keep the mind limber, and allow children to participate in the educational process. He was totally opposed to rote and drill learning. To Dewey, it was likely that a child who learned only to use a sledgehammer would treat everything as a spike. He believed the task of education was not to pass on conventional knowledge—such knowledge was often incorrect in any event—but rather to develop creative intelligence and versatility. The educator's function was not to transmit dogma, but to foster divergent thinking. Dewey made every attempt to present lessons in some context. For example, as the children learned basic arithmetic, they also learned to cook and serve lunch each week. In preparing the meals, they had to use arithmetic to follow the recipes. These were revolutionary ideas, and though Dewey had enthusiastic supporters, he also had critics. His school received only a small budget from the university and was supported almost entirely by fees and donations. It was a special annoyance to some members of the faculty of education that Dewey refused to allow formal teacher training in his school. Unfortunately, these critics were eventually able to convince the university's president that Dewey's school should be merged with the university department of education's Teacher Training Institute. The merger was arranged without consulting Dewey and without his consent. Dewey and his supporters were outraged, and though he was offered the directorship of the School of Education, Dewey refused. In 1904, he resigned from the University of Chicago faculty. Through the efforts of his friend Cattell, he was offered a position at Columbia University, where he remained for the rest of his life. In education, Dewey continued to lead the "progressive movement," which in later years became almost a parody of what Dewey intended it to be. In its first decades, however, this movement was a significant influence on the educational system of the United States.

Dewey's Later Life

Dewey was elected a charter member of the APA in 1892 and was elected the association's president in 1899. In 1910, he was the fourth psychologist elected to the National Academy of Science. However, after leaving Chicago, he turned more and more to philosophy and to educational and social commentary. Dewey was a prolific writer who addressed people from many walks of life. One listing of his bibliography covers seventy-five pages (Schilpp, 1939). Four biographies of Dewey have been written, and there is even a *Dewey Newsletter* that allows *Dewey Scholars* to keep in touch. Dewey was one of the founding members of the first teachers' union in New York City. Their motto, "Education for democracy and democracy for education," could well have been his personal creed. With Cattell, he was actively involved in establishing and organizing the American Association of University Professors and served as that organization's first president. Dewey also supported such liberal causes as the American Civil Liberties Union and the National Association for the Advancement of Colored People. At the age of 70, Dewey became interested in art; his mind was so versatile that he developed into an authority on the subject, writing books on art and aesthetics that were widely read and critically acclaimed. He was regarded as one of America's most important intellectuals—America's philosopher—yet he remained a modest, delightful person. One interviewer described Dewey at the age of 90:

> The widespread power of Dewey's thinking is all the more remarkable to look back upon when one considers its modest, personal source. John Dewey is a homespun, almost regional, character. To this day, on meeting him, one would imagine himself talking with a Vermont countryman, as seven generations of his forebears were. At many an academic gathering over the last fifty years, those who had come a long distance to see and hear the great John Dewey have been pleasantly discomfited to find that he was none other than the modest, gray-haired, stoop-shouldered man with a Green Mountain drawl and a chuckle and a grin to whom they had been speaking for the past ten minutes. (Edman, 1970, pp. 101–102)

Dewey's career as a psychologist essentially ended in 1904, yet he remains an influential figure in the history of psychology. He never did a controlled experiment, rarely conducted empirical studies, never designed or administered a psychological test, and certainly did not set out to found a school of psychology. Yet Dewey was a founder of American psychology, an important educational innovator, and one of the most celebrated public intellectuals of his time.

ANGELL AND CARR: FUNCTIONALISM AT THE UNIVERSITY OF CHICAGO

After Dewey had established functionalism as a psychological approach in his writings, others at the University of Chicago continued to expand his ideas. Foremost among these were James Rowland Angell and Harvey A. Carr.

JAMES ROWLAND ANGELL (1869–1949)

When Dewey left the University of Chicago, leadership of the Chicago school of *functionalism* was assumed by his student, James Rowland Angell. The two men had much in common. They had both been born in Burlington, Vermont—Angell on May 8, 1869—and could trace their ancestry to the original New Englanders, in Angell's case to the Mayflower settlers. Angell's father, James Burrill Angell (1829–1916), was president of the University of Vermont and later of the University of Michigan. At Michigan, Angell took a course in psychology taught by Dewey, using his *Psychology* as the text, and was fascinated by both course and instructor. He received an A.B. degree in 1890 and was encouraged by Dewey to stay on for a master's degree in philosophy. In his autobiography, Angell recalled his student years with Dewey and paid his former teacher this warm tribute: "I am under the deepest obligation to John Dewey, whose simplicity of character, originality and vitality of mind brought him the unqualified affection and devotion of thousands of students" (Angell, 1936, p. 6).

In 1891, Angell entered Harvard, where he studied under William James and the historian George Santayana[2] and did laboratory work with Münsterberg. James put him to work analyzing a great mass of material gathered by the American Society of Psychical Research. Angell was unable to draw any firm conclusions about the reality of psychical phenomena, but he did have the experience of working closely with James. After earning a second master's degree at Harvard, Angell was encouraged by his cousin Frank Angell to travel to Europe to work in Wilhelm Wundt's laboratory. Frank Angell had just returned from Leipzig and so was able to provide a letter of introduction. Unfortunately, when James Angell arrived at Leipzig, he found the laboratory full; the only thing Wundt could offer was an opportunity to attend his lectures. Angell had read Wundt's text and was already familiar with his psychology, and so he decided to move on. He spent some time with Hermann Ebbinghaus and was impressed with his memory research, but not with his style as a lecturer. He also met Hermann von Helmholtz. Finally Angell enrolled at the University of Halle, where he worked under Benno Erdmann, writing a Ph.D. dissertation on Kant's treatment of freedom in his *Critique of Pure Reason* (1781) and *Critique of Practical Reason* (1788). The dissertation was accepted contingent on being rewritten in better German. Angell planned to spend the next months revising it, but he unexpectedly received an offer of a position as an instructor in philosophy at the University of Minnesota that required him to return immediately for the start of the autumn quarter. The position carried a salary of $1,500, a strong attraction for a young man who had been engaged for four years and was keen to marry. Angell abandoned his dissertation and traveled to Minnesota. Later, as a university president, Angell conferred hundreds of doctoral degrees, but he never earned a Ph.D. himself. In 1895, after one year

[2] George Santayana (1863–1952) was the first and foremost Hispanic-American scholar. He wrote numerous scholarly works in history and philosophy. His admonition, "Those who cannot remember the past are condemned to repeat it" (Bartlett, 1992, p. 588) is often quoted.

at Minnesota, Angell was offered an assistant professorship in Dewey's department of philosophy at the University of Chicago. At Chicago, Angell rose through the academic ranks until he became the university's acting president in 1918.

Angell's Functionalism

In 1906, Angell served as president of the APA, and in his presidential address, "The Province of Functional Psychology," he gave a clear outline of his *functionalist* position. Angell began:

> Functional psychology is at the present moment little more than a point of view, a program, an ambition. It gains its vitality primarily, perhaps, as a protest against the exclusive excellence of another starting point for the study of the mind, and it enjoys for the time being at least the peculiar vigor which commonly attaches to Protestantism of any sort in its early stages before it has become respectable and orthodox. (Angell, 1907, p. 61)

Despite this modest beginning, the paper illustrates Angell's perception of functionalism as more than simply a protest against "another starting point for the study of the mind," namely, structuralism. He saw functionalism as an approach that differed in crucial ways from structuralism. First, Angell described functionalism as the psychology of mental operations or functions, while structuralism is the psychology of mental elements. Functionalism is the psychology of the how and why of consciousness; structuralism, the psychology of the what of consciousness. The structuralist asks, "What is the mind?"; the functionalist asks, "What is the mind for?" Second, the functionalist describes the operations of the mind and the functions of consciousness under actual life conditions. Consciousness is adaptive in that it allows people to function and to adapt to the demands of their environment. Thus, because consciousness mediates between the environment and the needs of the organism, it is active and forever changing. Consciousness cannot be stopped for an analysis of its structure. According to Angell, the moment of consciousness perishes, but mental functions persist. Psychology must therefore study thinking, not thoughts. Third, the functionalist assumes a constant interplay between the psychological and the physical. There is no real distinction between the two; they are one.

Angell's address was given when functionalism was at the peak of its importance and influence, a mature system of psychology. With that maturity came tolerance for diverse areas of psychology. One of the areas that grew rapidly at Chicago was comparative psychology, and Angell supported this development. He had a thorough understanding of Darwin and wrote a number of papers describing his theory of evolution and its psychological significance (Angell, 1909). Angell listed three primary contributions Darwin made to psychology: his doctrine of instinct, the notion of continuity among the minds of different species, and his study of the expression of the emotions. Angell was especially interested in the evolution of intelligence and the history of instinct. He did a number of experiments on maze learning by rats, investigating the sensory cues a rat uses in running through a maze. Angell's student John B. Watson (Chapter 12) was to further investigate this topic. Another of Angell's students, Walter S. Hunter (1889–1954), developed a delayed response test often used in experiments on animal memory.

During World War I, Angell served on the Committee for the Classification of Personnel, and when the war ended, he concentrated on administrative work at the University of Chicago. In 1919, he was elected president of the Carnegie Corporation, and the following year he became president of Yale University. He served as an educational adviser to the National Broadcasting Company (NBC). When Angell left Chicago, the chairmanship of the department of psychology passed to another of his students, Harvey A. Carr.

HARVEY A. CARR (1873–1954)

Harvey A. Carr—the initial did not signify a middle name, but was added by Carr to round out his signature—was born on an Indiana farm, went to Indiana public schools, and then, after working on his family's farm, enrolled at the University of Colorado at the age of 26. He received bachelor's and master's degrees at Colorado and in 1901 entered the University of Chicago as a graduate student. He worked as Watson's assistant in his courses on comparative psychology and studied with Angell. Later, Carr recalled Angell's personality:

> There was the keen and incisive intellect, the judicial attitude towards controversial questions, the delightful idiosyncrasies of manner and expression, the bubbling humor which ran the gamut from good-natured levity to brilliant wit, and the free and easy flow of choice diction which always seemed so well-adapted to the illumination of the topic under discussion. (Carr, 1936, p. 75)

Carr's dissertation at Chicago was entitled *A Visual Illusion of Motion During Eye-Closure,* a line of research which led to studies of autokinetic effects similar to those of Max Wertheimer (Chapter 7). Carr graduated in 1905 with the third doctoral degree in psychology awarded at Chicago. As no academic positions were available, he taught for two years in a Texas high school. In 1908, Watson left Chicago for Johns Hopkins, and Carr was appointed as his replacement. He taught the introductory, experimental, and comparative psychology courses. From 1920 to 1926, Carr directed the animal laboratory Watson had established. In 1926, he was appointed chairman of the department of psychology at Chicago, a position he held until 1938. In his autobiography, Carr (1936) reported that 130 doctorates were conferred during his years at Chicago and that he had considerable contact with all those students.

In 1927, Carr was elected president of the APA. In his presidential address, "Interpretations of the Animal Mind," Carr considered the evidence for assuming consciousness in animals and concluded that the only evidence for a positive conclusion lies in the similarity of the responses of humans and animals—a behavioral criterion. In studying animals, Carr was a thoroughgoing *behaviorist,* but in studying humans he refused to classify himself as a behaviorist, preferring a more flexible and wide-ranging approach. Carr was always suspicious of dogmatic, restrictive positions. For example, in considering depth perception, he concluded that both nativist and empiricist positions were of value. Although Carr was a careful and precise experimenter, he also saw that much important psychological work could be done without the use of experimental methods. Carr's major books were *Psychology: A Study of Mental Activity* (1925), a widely used introductory text, and *Introduction to Visual Space Perception* (1935).

Carr developed a mature functionalist position some years after the initial polemics and controversies had died down. Titchener had insisted that psychology study the world, with man left in; Carr's psychology would study "man left in the world" (Heidbreder, 1961, p. 230). His was a broad psychology rooted in the world of everyday affairs. In 1936, Carr ended his autobiography with these words: "I sometimes wish that I might be vouchsafed a glimpse of the Psychology or Psychologies of 1990, but perhaps it is just as well, for I might be woefully disappointed" (Carr, 1936, p. 82).

Carr always protested against the attempt to label him with any particular tag, even that of a functionalist, because he considered such labels unnecessarily restrictive. Perhaps Carr would not be disappointed to know that at the beginning of the twenty-first century, functionalism no longer exists as a formal school of psychology. Yet it surely would be encouraging for him to learn that the basic attitudes and approach of the functionalist psychologists are an important influence on contemporary psychology. It may not be too strong a statement to say that the majority of contemporary psychologists are functionalists even though they do not use the term.

WOODWORTH AND THORNDIKE: FUNCTIONALISM AT COLUMBIA UNIVERSITY

The department of psychology at Columbia University was the setting where the careers of the next two psychologists we will consider played out: Robert Woodworth and Edward Thorndike. Neither man was formally a member of the functionalist school, but they were clearly sympathetic to the approach of the Chicago psychologists. Woodworth and Thorndike first met as students, became lifelong friends and coresearchers, and for many years were colleagues at Columbia.

ROBERT SESSIONS WOODWORTH (1869–1962)

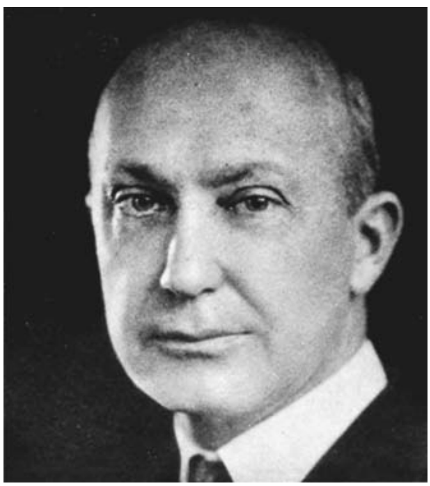
Woodworth's Early Life

Robert Sessions Woodworth was born on October 17, 1869, in Belchertown, Massachusetts. His family was of old New England stock, and one of his ancestors, Robert Sessions, had participated in the Boston Tea Party. In a letter to his family, Sessions had written a remarkably objective account of that historic incident:

> I was not one of those appointed to destroy the tea who disguised themselves as Indians, but was a volunteer, the disguised men being largely men of family and position in Boston, while I was a young man whose home and relations were in Connecticut. The appointed and disguised party proving too small for the quick work necessary, other young men, similarly circumstanced with myself, joined them in their labors.
>
> The chests were drawn up by a tackle—one bringing them forward in the hold, another putting a rope around them, and others hoisting them to the deck and carrying them to the vessel's side. The chests were then opened, the tea emptied over the side, and the chests thrown overboard.
>
> Perfect regularity prevailed during the whole transaction. Although there were many people on the wharf, entire silence prevailed—no clamor, no talking. Nothing was meddled with but the tea on board.
>
> After having emptied the hold, the deck was swept clean, and everything was put in its proper place. An officer on hand was requested to come up from the cabin to see that no damage was done except to the sea. (Sessions, 1774/2002)

Woodworth's father was a Congregationalist minister, and his mother was a college graduate and teacher. During Woodworth's childhood, his father held pastorates in New England, with shorter stays in Iowa and Ohio. Woodworth's mother was his father's third wife. Children had been born of each marriage, and so Woodworth grew up in a large family. His father was 55 years old at the time of Woodworth's birth, a stern, unyielding man who believed in firm discipline. Woodworth attended high school in Newton, Massachusetts, and graduated with the intention of becoming a minister. He enrolled at Amherst College and gained an A.B. degree in 1891. His main course work was in religion, classics, mathematics, science, and history. Only as a senior did Woodworth take a course in psychology. His religious vocation weakened, and he decided to become a schoolteacher. Woodworth taught science and mathematics for two

Robert Sessions Woodworth.
(Archives of the History of American Psychology, University of Akron)



years in a high school and then was an instructor for two years at a small college in Topeka, Kansas. During this period he had two experiences that changed his career plans. First, he heard G. Stanley Hall lecture. Woodworth was impressed by Hall's description of the new science of psychology and his emphasis on the importance of discovery through investigation. When he returned home after Hall's lecture, Woodworth printed the word INVESTIGATION on a card and hung it over his desk. The second experience was reading James's *Principles of Psychology.* As did many other students of his generation, Woodworth found the book captivating.

In 1895, Woodworth enrolled as an undergraduate student at Harvard University. He studied philosophy with Royce, psychology with James, and history with Santayana. At Harvard he also met Edward Lee Thorndike and Walter B. Cannon and began lifelong friendships with both men. James directed his research on time perception, thought, and language. At the time, James was also interested in the content of dreams, and he encouraged Woodworth to keep a dream diary. They were unsuccessful in trying to correlate the content of his dreams with specific events during the day, but they did notice that Woodworth often dreamed about matters that had been interrupted during the day, an unconscious manifestation of the effect Bluma Zeigarnik was to report some thirty years later (Chapter 7).

In 1896, Woodworth received a second bachelor's degree from Harvard, and from 1897 to 1898 he was an assistant in psychology at the Harvard Medical School. There he saw Cannon's experiments on stomach movements and hunger and on visceral processes in emotion (Chapter 9). At the end of that year, Cattell offered him a graduate fellowship at Columbia. Cattell's approach to psychology, with its emphasis on precise testing of psychological functions, appealed to Woodworth, and he accepted. He received a Ph.D. under Cattell in 1899. In his dissertation research, Woodworth studied the accuracy of voluntary movements under the control of different sensory systems. He visited Europe in 1900 and attended the Second International Congress of Psychology, where he met a number of well-known European psychologists, including Hermann Ebbinghaus, Pierre Janet (Chapter 8), and Karl Pearson (Chapter 9).

Woodworth's Early Research

Thorndike had accepted a position at Columbia in 1899. With him, Woodworth conducted a series of experiments on transfer of training, that is, the effects of improvement in one mental function on the efficiency of other functions. Thorndike and Woodworth first described their results in a paper presented at the December 1899 meeting of the APA and then in three papers published in the 1901 *Psychological Review.* The background to their experiments was the educational doctrine of *formal discipline.* As we saw in discussing James's research (Chapter 9), this popular doctrine argued that it is possible to exercise and discipline the mind. Through hard work and study of the "disciplinary subjects," especially Latin, Greek, and mathematics, the mind's fibers supposedly would become more active, agile, facile, and powerful. This muscular doctrine was widely accepted and formed a cornerstone of much of the educational philosophy of the time. The following statement by Joseph Payne, a respected nineteenth-century educational theorist, is representative of the views at the time:

> My first proposition is that the study of the Latin language itself does eminently discipline the faculties, and secures to a greater degree than that of other subjects we have discussed, the formation and growth of those mental qualities which are the best preparatives for the business of life—whether the business is to consist in making fresh mental acquisitions, or in directing the powers thus strengthened and matured, to professional and other pursuits. (Payne, 1883, p. 264)

Children were taught Latin, Greek, and other "disciplinary subjects" not for their intrinsic value, but to exercise and develop their minds. Sadly, such children often learned only to hate these subjects and to exercise their minds with chants such as the following:

> Latin is a language, dead as dead can be.
> It killed the ancient Romans and now it's killing me!

Some school administrators questioned the value of such subjects as Latin and formal mathematics and recommended that they be removed from the curriculum. Woodworth and Thorndike sought to resolve this issue empirically. Their experiments were more elaborate than those of James. First they studied such mental functions as area estimation and judgment of length or weight; then they gave their subjects training either on the function tested or on another function; finally, they retested their subjects on the original task. Even with tasks that superficially seemed alike there was often little positive transfer, and at times the effect was negative. Their results thus gave no support to the doctrine of formal discipline, for when positive transfer did occur, it did so on the basis of specifically similar work methods. John Coover, a Stanford psychologist, and Frank Angell were supporters of the doctrine of formal discipline. They criticized Thorndike and Woodworth's research as being "rough experiments of very little value" (Coover & Angell, 1907, p. 330), and pointed out the absence of a control group equal to the experimental group in all respects but the training (Dehue, 2000, p. 266). Nevertheless, Woodworth and Thorndike had established a paradigm that has been used in hundreds of transfer experiments over the last century.

Transfer can be a powerful influence on our lives. When it is positive—learning to drive a truck after having learned to drive a car—the effect is welcome. When it is negative—driving in England on one side of the road after having learned to drive in America on the other side—the effect can be disastrous not only for drivers but also for pedestrians. On his first visit to the United States, Winston Churchill stepped off a curb, looked the wrong way for approaching traffic, and was hit by an automobile—all within an hour of his arrival. When Christopher L. Sholes invented the modern typewriter in 1867, his machine had a sluggish mechanism, so he deliberately scrambled the letters on the keyboard to prevent overly rapid typing (Salthouse, 1984). Today, on machines that are capable of high typing speeds and even on computer keyboards, we still use the scrambled arrangement of letters Sholes introduced, even though it is possible to design a more efficient keyboard. In 1932, an American educator, August Dvorak, designed a keyboard in which all the vowels and major consonants are grouped together in the middle row. With this keyboard the speeds of novice typists increase by 30 to 50 percent, but imagine the massive negative transfer skilled conventional keyboard typists would experience if they tried to use the new keyboard.

Woodworth was interested in physiology and spent 1902 on a fellowship in the laboratory of Charles Sherrington (1857–1952) at the University of Liverpool in England. At the time, Woodworth's aim was to make "his psychology contribute to a career in brain physiology, rather than vice versa" (Woodworth, 1932, p. 368). Sherrington offered him a position in his laboratory, as did Cattell. Woodworth decided to accept Cattell's offer and returned to Columbia and to psychology. He remained there for the rest of his life.

Woodworth's Psychometric Studies

As we have seen, Cattell had established a strong tradition of psychological testing at Columbia (Chapter 9). The organizers of the 1904 St. Louis Exposition asked him to conduct tests with people of many different races who would be attending the fair. Cattell saw this as a valuable opportunity to collect anthropological and psychological data. He put Woodworth in charge of the project, and under Woodworth's supervision nearly 1,100 people were tested. Woodworth presented his results in his vice-presidential address to the American Association for the Advancement of Science in 1909. Woodworth took a remarkably sensible and fair-minded position on racial differences in test performance. He acknowledged that scientists hope to discover an orderly universe and often try to develop classifications. However, he also pointed out that anthropological and psychological classifications are often based on physical (light-skinned versus dark-skinned) or assumed physiological (large-brained versus small-brained) or psychological (intelligent versus dull) characteristics. Woodworth stressed that such characteristics are not equally measurable, and even if they were, they are always distributed within a population. They vary from person to person within the population, and this individual variation is often greater than the between-population differences. Claims of clear-cut racial differences are misleading, Woodworth stressed, because they emphasize differences between group averages and ignore the large degrees of overlap (Woodworth, 1910).

At St. Louis, Woodworth and his coworkers also used tests of sensory acuity. They found that, on the whole, sensory acuity is about the same in different races. They did find some striking examples of acute vision, hearing, taste, touch, and smell, but these characteristics were found among all racial groups. When he considered the question of racial differences in intelligence, Woodworth foresaw the problems of comparing racial groups. He was pessimistic that such comparisons could ever be made. Woodworth also criticized the then-popular way of assessing the intelligence of groups of people by studying their cultures. He pointed out that the German culture of his time was often judged to be more advanced than that of the Romans. Did that mean that contemporary Germans were mentally more advanced than the Romans? Since on an evolutionary time scale the distance between the Romans and Germans was small, it would be extraordinary indeed if such a change in mental status had occurred. Woodworth criticized those who would label one group of people as being more "primitive" or "advanced" than another group. Each group must be considered in terms of its habitat, group size, migration opportunities, and customs. Woodworth's views were judicious and prescient, and it is unfortunate that his warnings and admonitions were not widely heeded.

In 1906, the APA appointed a committee to study tests and measurements. Woodworth served on a subcommittee that developed and studied specific tests: color- and form-naming tests, a logical relation test, and a test of ability to follow instructions. When the United States entered World War I in 1917, the APA asked Woodworth to develop a test of emotional stability that would detect a soldier's potential to develop "shell shock" or "war neurosis." He collected a list of hundreds of symptoms of shell shock from case histories and arranged them in a questionnaire. Single questions were to be answered *yes* or *no.* Then Woodworth tried this personal data sheet out on one thousand recruits and a smaller number of men suffering from shell shock and battle fatigue. The aim was to develop an instrument that would show the need for more intensive counseling or psychological help for a recruit who might otherwise experience serious problems in combat. The war ended before the data sheet could be used extensively, but it later formed the basis of a number of personal data inventories for the measurement of neuroticism.

Woodworth was an active author. He published an extensive evaluation of G. T. Ladd's *Physiological Psychology* (Ladd & Woodworth, 1911) and after the war began a task that was to take nearly twenty years—writing his monumental *Experimental Psychology.* This book was finally published in 1938 and quickly became a definitive text. Published in a revised edition coauthored by Harold Schlosberg (1954), this book taught experimental psychology to thousands of students. In the 1920s, Woodworth began work on a history of psychology that was published in 1932 as *Contemporary Schools of Psychology.* He presented the different schools of psychology as complementary to one another; he denied that any one approach to psychology was *the* approach, but instead took a tolerant, open-minded view. In writing this book, Woodworth was in a unique position, for the fifty years of the history of psychology he described were his own years as a psychologist. In a quiet, unassuming way he had emerged as the dean of American psychology. The last chapter in his book, entitled "The Middle of the Road," ends with these typically Woodworthian words:

> Every school is good, though no one is good enough. No one of them has the full vision of the psychology of the future. One points to one alluring prospect, another to another. Every one has elements of vitality and is probably here to stay for a long time. Their negative pronouncements we can discount while we accept their positive contributions to psychology as a whole. (Woodworth, 1948, p. 255)

Babe Ruth at Columbia University[3]

In the summer of 1921, Babe Ruth visited the laboratory of psychology at Columbia University. Ruth was having yet another outstanding year for the New York Yankees and was widely acknowledged to be the greatest hitter baseball had ever seen. The *New York Times* hailed him as "supernormal." For three hours, two psychologists at Columbia, Albert Johanson and Joseph Holmes, tested Ruth's physical and mental capacities. They measured:

- Breathing while hitting (measured on a pneumograph)
- Bat speed (by attaching wires to a Hipp chronoscope)
- Simple reaction times to both lights and sounds
- Attention span—that is, the number of stimuli correctly perceived in a brief visual exposure
- Attention to specified elements—for example, marked vowels in a prose passage
- Ability on a Digit Symbol Test which substituted arbitrary symbols for designated digits
- Hand coordination and speed of hand movement

Ruth's results were impressive: while hitting, he held his breath until the ball was struck; his bat speed was estimated to be sufficient to send a ball up to 500 feet; Ruth's visual and auditory reactions were 20 and 10 milliseconds faster, respectively, than average; his span of attention was judged superior and his attention 50 percent better than average; his digit symbol results were average; and his hand coordination and speed were 50 percent better than average.

Babe Ruth's participation in this study is remarkable. The validity of the test results was apparently confirmed when Ruth hit 59 home runs in 1921 with a home run for every 11.8 times at bat, a single season record. Fullerton concluded:

> The secret of Ruth's ability to hit is clearly revealed in these tests. His eye, his ear, his brain, his nerves all function more rapidly than do those of the average person. Further, the coordination between eye, ear, brain, and muscle is much nearer perfection than that of the normal healthy man. (Fuchs, 1998, p. 160)

A cover story in Cattell's *Popular Science Monthly* proclaimed "Babe Ruth's Home Run Secrets Solved by Science." That claim was premature, and it was only in the last decades of the twentieth century that sport psychology gained recognition as a field of psychology with its own practitioners. *Journal of Sport Psychology* was founded in 1979, and the Exercise and Sport Psychology division of the APA was established in 1986.

[3] This material is from "Psychology and the Babe" by Alfred H. Fuchs, published in *The Journal of the History of the Behavioral Sciences, 34* (Spring 1998), 153–165.

Imageless Thoughts

In 1914, Woodworth was elected president of the APA. In his presidential address he discussed the question of imageless thoughts, a topic he had first studied in his dissertation experiments. He found that some voluntary movements occur without images and sensations. Oswald Külpe and Alfred Binet (Chapters 6 and 11) had reported similar results, and Woodworth spent the summer of 1912 working in Külpe's laboratory. Titchener had criticized claims of imageless thoughts; he held that sensations and images are always present in thinking (Titchener, 1921c, 1922a). Woodworth was prepared to admit that they are present in many and perhaps even in most thoughts, but not in all: some thoughts occur without sensations and images. To study these imageless thoughts, Woodworth introspected at the times when new ideas came to his mind. Rather dryly, he pointed out that observational opportunities were limited, for new thoughts did not come to mind as often as he would have liked; but when they did, his introspections did not show sensations and images. New thoughts seemed to "come to mind" without specific content. Woodworth concluded that such new ideas are determined by memories of past experiences. Woodworth described an experiment he did with Thorndike in which subjects were asked to recall a scene, for example, the front of the United States Supreme Court building. Most people had seen the building or photographs of it and so were able to recall its appearance. However, when asked how many columns the building's portico had, they were unable to say unless they had previously counted them and remembered the fact.

In his research on imageless thoughts (Woodworth, 1915), we see Woodworth's willingness to use whatever approach was best. He was never doctrinaire. At times, he considered behavioral approaches most appropriate; at other times, such as in the study of imageless thoughts, introspection was best. Woodworth always opposed narrow, restrictive approaches to psychology. The proponents of such approaches—Titchener and Watson—he called his "bogeymen," and he vowed never to accept their "epistemological tables of commandments" (Woodworth, 1932, p. 376). In studying the workings of the mind, Woodworth saw the need for different approaches. He realized that his middle-of-the-road approach ran the danger of being called "merely eclectic," firmly anchored in mid-air, but Woodworth was prepared for such criticism.

Woodworth's Motivational Psychology

In accord with the Chicago functionalists, Woodworth could not accept mechanistic stimulus-response (S-R) conceptions of behavior. For him, stimuli do not cause responses; they excite the response, but the form and energy of the response may be independent of the stimulus. One example Woodworth gave is that pulling a trigger causes a gun to fire, but the bullet's velocity is determined by the characteristics of the gun and the bullet, not by how hard the trigger is pulled. Woodworth also pointed out that the same behavioral response can be elicited by many stimuli. Sherrington (1906) had referred to the "receptive field" of a reflex; a cat's scratch reflex can, for example, be elicited by stimuli on many parts of the body. Woodworth also stressed the state or condition of the organism receiving the stimulus. Rarely does a stimulus reach an organism at rest, and the organism's activity often affects its response. Motivational variables are important determinants of this background activity. Throughout his career, Woodworth stressed the effects of drives; in fact, he introduced and popularized the term *drive.* Why do we do one thing rather than another? Why do we put different energies into different activities? Woodworth attempted to answer these questions in his book *Dynamic Psychology* (1918) and, forty years later, in *Dynamics of Behavior* (1958). Basic drives arise from the organism's biological needs; they include the drives for food, water, and sexual contact. Other drives consist of neuromuscular preparations for stimuli; for example, an athlete at the starting blocks is motivated to respond to the starter's gun. Other drives may be personal ambitions or professional interests. Woodworth believed that all of them are important influences on behavior and mental processes. Any psychology that ignored them, he thought, would necessarily be incomplete.

To emphasize the importance of motivation, Woodworth modified the S-R formula to include the organism (O). His modified formula was S-O-R. Woodworth wrote of this revised formula:

> The O inserted between S and R makes explicit the obvious role of the living and active organism in the process; O receives the stimulus and makes the response. This formula suggests that psychologists should not limit their investigations to the input of stimuli and the output of motor responses. They should ask how the input can possibly give rise to the output; they should observe the intervening processes, if possible, or at least hypothesize them and devise experiments for testing the hypotheses. (Woodworth, 1958, p. 31)

Woodworth also addressed a vexing problem psychologists have in describing the phenomena they study. The technical vocabulary of psychology consists of terms such as *intelligence, habit, drive, feeling,* and *emotion* that have everyday meanings. However, although psychologists may wish to restrict these terms to particular technical meanings, it is often difficult to do so; the everyday meanings persist. Sciences such as physics and chemistry do not have this difficulty because they have developed their own technical vocabularies. Today, though, this may be changing; particle physicists refer to the "behavior of atoms" and to six known quarks—up, down, strange, charm, top, and bottom. Not to be outdone, physicists studying superfluidity have offered "the boojum" (Waldrop, 1981). At times, psychologists have resorted to operational definitions—*intelligence* is what an intelligence test measures, *hunger drive* is the result of so many hours of food deprivation—but such definitions are not completely satisfactory. In his presidential address to the APA, Woodworth suggested that psychologists consider inventing a technical vocabulary. Even the term *psychology* seemed so overloaded with connotations of soul and psyche as to be worthless. Woodworth proposed that it be replaced with the term *motivology.* He also made two other suggestions. Rather than *conscious attitudes,* psychologists should refer to *marbs* in honor of Marbe, the psychologist who had studied them, and they should refer to *thoughts* as *kulps* in honor of Külpe (Chapter 6). Woodworth's suggestion was never followed, but some additional examples come to mind. Nonsense syllables might be *ebbs* in honor of Ebbinghaus, reinforcers *burrhuses* in honor of Skinner, intelligence testing *bineting* in honor of Binet. Finally, drives would certainly have to be *woodworths.*

Woodworth had no wish to develop or lead a school of psychology. He was always a modest man and seems to have consistently underestimated his many contributions to psychology. In his autobiography, he mentioned that he had participated in activities of the National and Social Research Councils but characteristically did not mention that he had been chairman of the National Research Council's Division of Anthropology and Psychology and president of the Social Research Council. Fortunately, his many contributions were recognized and Woodworth was awarded many honors, including the presidency of the APA in 1914 and election to the first board of directors of the Psychological Corporation in 1921, a position he held until 1960. In 1956, he was awarded the first gold medal of the American Psychological Foundation for:

> Distinguished and continuous service to scholarship and research in psychology and for contributions to the growth of psychology through the medium of scientific publication. (Poffenberger, 1962, p. 689)

Woodworth officially retired from Columbia on his seventieth birthday, but he continued to lecture until he was 89 years old and to write until he was 91. He died on July 4, 1962.

EDWARD LEE THORNDIKE (1874–1949)

Thorndike's Early Life

Thorndike, Woodworth, Angell, and Dewey were all sons of old New England families. In Edward Lee Thorndike's case, that family could trace its ancestry back to 1630 and included farmers, lawyers, and storekeepers. Thorndike was born on August 31, 1874, in Williamsburg, Massachusetts. He was the second of four children, all of whom had important scientific careers. His mother was a resolute Victorian housewife, his father a Methodist minister. Ministerial appointments in the Methodist church of the late nineteenth century were for short periods of rarely more than three years, so Thorndike grew up in a succession of New England towns. He was strongly motivated to succeed, found schoolwork easy, and was a brilliant student. He was also painfully shy, often lonely, and very conscious of being a "minister's kid." Thorndike graduated in 1891, having ranked first or second in all his high school courses.

In 1891, Thorndike entered Wesleyan University, a school founded by the Methodist church where his older brother, Ashley, was a student. Thorndike had a brilliant academic record there and each year won at least one major academic prize. He also edited the college newspaper and played competitive tennis. However, he was still very shy and envied his older brother, who in addition to being a brilliant student was poised and popular. At Wesleyan, students in their junior year were required to take psychology, a course that Thorndike found dull. However, as a candidate for an academic prize, he was required to read James's *Principles of Psychology.* Forty years later, Thorndike remembered the James book as more stimulating than any book he had read before or since. As an undergraduate, he bought the book, the only nonliterary work he purchased, and even went so far as to reproach the faculty member who taught the psychology course for not using *Principles of Psychology* as his text. Thorndike graduated in 1895 with *Phi Beta Kappa* honors, earning the highest academic average achieved at Wesleyan in fifty years (Joncich, 1968).

Thorndike's Animal Learning Experiments at Harvard

Thorndike then entered Harvard University, where he planned to study English, philosophy, and psychology. His interest in English and philosophy soon waned, but his contacts with James strengthened his interest in psychology. In 1896, he began his first independent research. This work was inspired by James's belief that in mind-reading demonstrations, the person whose mind is supposedly being read may unconsciously make subtle facial movements that provide cues for the "mind reader." The hypothesis of the experiment was that children may see such subtle movements more easily than adults, and so Thorndike studied 3- to 6-year-old children. He sat facing a child and thought of a number, letter, or object while the child tried to guess what he was thinking. His results showed no support for the hypothesis, but the experimental procedure included one significant detail: for each correct guess, the child received a piece of candy. This was Thorndike's first use of an explicit reward. While the children enjoyed the experiments, the school authorities became suspicious of Thorndike's "mind reading" and refused to allow them to continue. Therefore, Thorndike was forced to consider other research possibilities. In his autobiography, Thorndike described how he began his experiments on learning in chickens:

> I then suggested [to James] experiments with the instinctive and intelligent behavior of chickens as a topic, and this was accepted. I kept these animals and conducted the experiments in my room until the landlady's protests were imperative. James tried to get the few square feet required for me in the laboratory, and then in the Agassiz Museum. He was refused, and with his habitual kindness and devotion to underdogs and eccentric aspects of science, harbored my chickens in the cellar of his own home for the rest of the year. (Thorndike, 1936, p. 264)

Using stacked books as walls, Thorndike built a number of pens for the chickens. With the assistance of two neighborhood children, he ran an experiment in which a chicken had to find its way out of the pen to a surrounding enclosure containing food, water, and other chickens. First the chicken would run up and down, peeping loudly and showing clear signs of distress. After many unsuccessful attempts, the chicken would finally find the exit and leave the pen. When a chicken was repeatedly placed in the pen, it ran to the exit more and more rapidly. Thorndike found that the chickens had learned to escape from the pen:

> The chick, when confronted by loneliness and confining walls, responds by those acts which in similar situations in nature would be likely to free him. Some one of these acts leads him to the successful act, and the resulting pleasure stamps it in. Absence of pleasure stamps all others out. (Thorndike, 1911, p. 64)

In view of their significance, it is important to consider the background of these experiments. Thorndike gave the following practical reasons for conducting them:

> The motive for my first investigations of animal intelligence was chiefly to satisfy requirements for courses and degrees. Any other topic would certainly

> have served as well. I certainly had no special interest in animals and had never taken a course in biology until my last year of graduate work, when I worked hard at it and completed a minor for the doctor's degree. (Thorndike, 1936, p. 165)

Certainly such practical considerations were important, but the question remains: Why did Thorndike choose to experiment with chickens? At the time, there was no tradition of such research at Harvard; any influence must have come from elsewhere. It seems likely that one source was the work of one of the British followers of Charles Darwin, C. Lloyd Morgan (Chapter 9). In 1894, Morgan had published *Comparative Psychology,* which included descriptions of experiments in which chickens had learned to discriminate between different-colored kernels of corn. Some kernels were dipped in quinine to make them taste bitter, others in sugar water to make them taste sweet. The chickens learned quickly to peck only at the sweet-tasting kernels. Lloyd Morgan gave the Lowell Lectures at Harvard in 1896, describing his approach to comparative psychology and his learning experiments with chickens. That year was Thorndike's first year at Harvard, but he made no mention of attending Morgan's lectures, though it seems likely that he did. Later he was to quote Morgan extensively (Stam & Kalmanovitch, 1998).

Thorndike at Columbia University: Cats in a Puzzle Box

Despite the success of the learning experiments with chickens and his admiration for James, in 1897 Thorndike decided to leave Harvard. He wished to leave New England for a personal reason—the rejection of a marriage proposal he had made. Thorndike accepted Cattell's offer of a graduate fellowship at Columbia University and moved to New York City, taking with him in a basket his two most highly trained chickens. Originally he intended to study Lamarckian inheritance of acquired characteristics with these chickens, but Thorndike, a young man in a hurry, soon realized that such a study would take a long time and abandoned it. Cattell approved an extension of his Harvard research on "the mental life of animals." Thorndike proposed to study the formation of associations by extending his experiments with chickens to other species. His plan was accepted. At first he kept chickens and a kitten in his apartment—his neighbors thought he was a circus animal trainer—but after a near fire in an incubator, his landlady insisted that the chickens be removed. Cattell was able to find some space for Thorndike in the attic of a building at Columbia, and there Thorndike established his animal laboratory. He acquired seven kittens and six young cats, the subjects for his most famous experiments.

Thorndike built fifteen puzzle or problem boxes. A hungry cat placed in a box was required to learn to escape and obtain food by making a specific response, such as pushing a pedal or pulling on a looped rope. When the response occurred, Thorndike opened the box door and allowed the cat to escape. When first placed in these boxes, the cats showed a great deal of hit and miss, or what Thorndike called "trial-and-error" behavior: scratching at the walls, attempting to squeeze through small openings and gaps, clawing at the wire netting, and the like. Eventually, apparently by accident, the correct response would occur, and the cat would escape and reach the food. With training, the amount of trial-and-error behavior decreased so that eventually the cats could escape from the boxes quickly and smoothly.

Thorndike considered the learning he had observed to be governed by what he called the *Law of Effect.* He saw the problem box as a stimulus situation in which a hungry cat makes a variety of responses. Most of the responses resulted in "annoyers," that is, failures to escape from the box and gain food, so the association or connection between those responses and the stimulus situation weakens. A much smaller number of responses led to "satisfiers," that is, escape from the box and access to food, and so the connection between those responses and the stimulus situation strengthens. According to Thorndike, satisfiers and annoyers act selectively to "stamp in" certain stimulus-response connections and to weaken others. Responses that produce satisfiers have their connection to the situation "glued" more strongly than do responses that produce annoyers, which have their connection weakened. Thorndike gave an elegant explanation of the learning he had observed. For more than forty years, his explanation was central to psychologists' conceptions of animal learning. Tolman (Chapter 9) observed, "The psychology of learning has been and still is primarily a matter of disagreeing with Thorndike, or trying to improve in a minimum way upon him" (Tolman, 1938, p. 11). Explanations of learning were, indeed, almost always a matter of either agreeing or disagreeing with Thorndike. His classic experiments had a number of other important characteristics. First, Thorndike included only one illustration in his monograph describing the results of his experiments (Thorndike, 1898a). His drawing of Box K shows a neat, tidily constructed box that has been reproduced in numerous psychological texts as an example of the type of box Thorndike used. It is, however, a misleading example. Photographs of the boxes he used (Burnham, 1972) show that they were very different from this tidy drawing. Odd pieces of lumber protrude at various angles, unhammered nails stick out, and the walls, floors, and roofs are often crooked. In general, the boxes have a rickety, thrown-together appearance, and a number of labels show their origin as fruit and vegetable crates. Thorndike disliked tools and machines—as an adult he was never able to learn to drive a car—and it is clear that his carpentry skills were limited. Thorndike's elegant research was therefore done using the crudest apparatus. A second important point is that Thorndike used fifteen different boxes in his experiments. They required different escape responses, and one of his most important findings was that the animals did not learn these responses with equal ease. All the cats learned to escape from five boxes that required discrete, single responses: clawing or pulling a string, pushing a button, pawing a lever. However, four of the ten cats tested in a box requiring a multiple response—pulling a loop and then moving a stick or two bolts—did not learn to escape; five of the eight cats tested in a box requiring that a thumb latch be moved with a force of at least 400 grams were also unsuccessful. Thorndike believed that the cats had difficulty learning to make these escape responses because the responses lacked simplicity and definitiveness.

Thorndike also found that when cats were tested in a number of boxes, they became progressively better at learning to escape. They became "box-wise" and were able to learn new escape responses with a minimum of difficulty. They had developed what Harry Harlow (1905–1982) many years later

Box Z and Biological Constraints on Learning

Some of the most interesting results Thorndike reported came from his observations of the behavior of cats in Box Z, which was entirely closed except for a small opening in the left-hand corner. To escape from this box, the cats had to lick or scratch themselves. In their home cages, they often made these responses, but they had difficulty learning to make them to escape from Box Z. While every cat eventually learned to escape from the box, the formation of the association was slow and difficult. Unlike the smooth, coordinated responses they made in the other boxes, licking and scratching were labile and tended to diminish so that they eventually became mere vestiges of the original acts, for example, a rapid waving of the paw up and down rather than a hearty scratch. If the door did not open immediately after a lick or scratch, the response was not repeated, unlike the vigorous repetitions of other responses. Some responses were not easily learned.

Fifty years later, two psychologists—Keller and Marian Breland—were initially successful in training animals for a variety of advertising, entertainment, and commercial displays. Chickens were conditioned to "play" a piano or to "lay" a certain number of eggs upon command (Breland & Breland, 1951). So successful were their early attempts that the Brelands confidently predicted that psychologists would supplant conventional animal trainers in a variety of settings. Ten years later (Breland & Breland, 1961), they were much less confident. In their continuing efforts to train animals, they had encountered numerous examples of animal misbehavior. Despite their best efforts, animals could not be trained to perform certain responses, much like Thorndike's cats in Box Z. For example, the Brelands were unable to train a chicken to stand still for food; a pig trained to drop "coins" into a "piggy bank" became a reluctant depositor, spending an increasing amount of time rooting and tossing the coins; a raccoon trained for a similar exhibit would not let go of the coin, but instead would rub it up and down the sides of the container for extended periods of time. In these and similar cases, the animal's natural food-getting behaviors interfered with the performance of the conditioned behavior. While initially dismissed as the report of unsuccessful animal trainers, their "Misbehavior of Organisms" paper (1961) became one of the most oft-cited papers in the animal learning literature (Seligman & Hager, 1972). Their results are similar to Thorndike's and an anticipation of the later concern with "biological constraints upon learning" and contemporary results showing that not all behaviors can be modified equally readily by reinforcement (Hinde & Stevenson-Hinde, 1973; Shettleworth, 1973).

was to call *learning sets* (Harlow, 1949). Finally, Thorndike observed no beneficial effects of imitation (seeing another cat solve the problem) or of being "put through" the problem by having the human experimenter move the animal's limbs through the requisite motions.

These are all classic results, and it is extraordinary that Thorndike did the experiments in less than a year. He first described his results in "Experiments on Comparative Psychology," a paper presented at the January 1898 meeting of the New York Academy of Science, and then in "Some Experiments in Animal Intelligence," published in *Science* in June 1898. His thesis, *An Experimental*

Study of the Associative Processes in Animals, was accepted by Columbia in 1898 and published as a monograph supplement in the *Psychological Review* of that year. Finally, at the end of an impressive year, Thorndike described his results at the December 1898 meeting of the APA. Thorndike's ambition was to make it to the top of psychology within five years; he was well on the way to doing so.[4]

Many psychologists, including James and Cattell, regarded Thorndike's learning experiments as a major step forward in the study of animal intelligence. However, Thorndike also had critics whose attention he welcomed. In a letter to a friend he wrote, "I've got some theories which knock the old authorities into a grease spot" (Joncich, 1968, p. 146). After the APA meeting, Thorndike wrote to his fiancée that his paper had been severely criticized by an "old oak" (Joncich, 1968, p. 146). The "old oak" was T. Wesley Mills (1847–1915), a comparative psychologist from McGill University in Montreal. The following year, Mills renewed his criticism of Thorndike's experiments in a long paper entitled "The Nature of Animal Intelligence and the Methods of Investigating It," published in the May number of the *Psychological Review* (Mills, 1899). Mills criticized Thorndike for neglecting the work of previous investigators:

> Dr. Thorndike has not been hampered in his research by any of that respect for workers of the past of any complexion which usually causes men to pause before differing radically from them, not to say gleefully consigning them to the psychological flames. For Dr. Thorndike, the comparative psychologists are readily and simply classified—they are all insane—the only difference being the degree, for he speaks of one of them as being the "sanest" of the lot. (Mills, 1899, p. 263)

This neglect of previous work was entirely intentional on Thorndike's part. He hoped to sweep away the entire fabric of comparative psychology and start anew. Comparative psychology must reject the anecdotal reports of such investigators as Romanes (1912) (Chapter 9) and replace them with objective experiments. Romanes had made much of dogs' "homing instinct" of dogs and had included reports of lost dogs finding their way home over many miles, but as Thorndike noted, "Dogs get lost hundreds of times and no one ever notices it or sends an account to a scientific magazine. But let one find its way from Brooklyn to Yonkers and the fact immediately becomes a circulating anecdote" (Thorndike, 1898a, p. 24). The only earlier work of any value was that of Lloyd Morgan, the man Thorndike called the "sanest of an insane lot." But Morgan (1900), too, had harshly criticized his research, suggesting that Thorndike's cats should be described as his "victims" (Galef, 1998, p. 1130).

Mills also criticized Thorndike for the situations he had used in his experiments. He stressed that, "When animals are removed from their usual, not to say natural, surroundings, they may be so confused or otherwise disordered that they fail to act normally, and this I have illustrated by experiments" (Mills,

[4] Also in 1898, Elizabeth Moulton, the woman who had earlier rejected his proposal of marriage, agreed to be his wife.

1899, p. 266). Mills claimed that Thorndike's animals had been in a state of panic and so had failed to act intelligently. Their situation, Mills said, was like that of "a living man in a coffin" (Mills, 1899, p. 266). His own experiments with dogs in field and farm situations had shown them to be capable of highly intelligent behavior. Mills claimed that if Thorndike had observed the behavior of these animals ". . . even one so fast bound in the grip of his own experience as he, would have altered his opinion on this and many other subjects" (Mills, 1899, p. 266).

In the June 1899 number of the *Psychological Review,* Thorndike replied to these criticisms in a harsh rebuttal. He admitted that Sir John Lubbock had used a method similar to his own in experiments with insects and acknowledged the value of his contribution. (At least one additional earlier worker was now seen to be quite sane.) Thorndike also admitted that at times his animals did panic and show signs of violent behavior. However, these reactions had occurred only on the early trials and had not, according to Thorndike, interfered with formation of the association. Rates of learning were similar in animals that did and did not show this early panic. Thorndike reported that his cats went into the boxes freely and of their own accord over and over again. Surely they would not have done so if they had been panic-stricken. He also accepted Mills's description of his situations as unnatural, but pointed out that was exactly what he had intended them to be. His aim was to have his cats learn a novel and unfamiliar action; he did not want to study natural or instinctive reactions. Thorndike questioned Mills's description of his situations as artificial. His cats had spent most of their lives living in a laboratory, so for them the situation was not artificial; it was as natural for them as a farmyard was for a farm cat. This Thorndike-Mills debate had its share of personal and emotional arguments, but it is fascinating because of the speed with which it was joined and the fact that the issues they debated have recurred repeatedly in the recent literature on animal learning.

Thorndike and Education

After he earned a Ph.D., the best position Thorndike could find was one as an assistant professor of pedagogy at the College for Women of Western Reserve University in Cleveland, Ohio. As his brother Ashley was on the faculty, Thorndike went to Cleveland with high hopes, but the year turned into a time of unhappiness in what he considered academic exile. He knew very little pedagogy and had to spend a frantic six weeks becoming familiar with the literature. Much of the time, he was only one step ahead of his students, and in his lectures he often had to "bluff." Thorndike wanted most to continue his experiments, which he called his "stunts," but the campus had no facilities for animal research. At the end of a year, he was delighted to receive a call from Cattell asking him to join the founding faculty of Teachers College at Columbia. He returned to New York in 1899.

Thorndike remained at Teachers College for the rest of his academic career, forty-three years during which he averaged ten publications a year. Many of these publications were major works. His *Educational Psychology,* for example, published in 1913, was a three-volume work. Thorndike described his publications as "opportunistic," as many of them were written as adjuncts to the courses he taught. He distrusted students' ability to take accurate notes and so wrote books for them to read. His approach led to some criticism. Following the publication of Thorndike's *Elements of Psychology* (1905), Titchener issued this stinging rebuke:

> Professor Thorndike finds it necessary, or profitable, to publish his lecture courses as soon as the lectures have been delivered. Work put out in this way may very well be clever and original and suggestive, but it must inevitably show marks of hasty preparation and of immaturity of judgment. (Titchener, 1905, p. 552)

Such criticisms, however, were passing setbacks, and Thorndike's career developed apace. Cattell supported him enthusiastically, and within five years Thorndike was promoted to the rank of professor at more than double his starting salary. Initially, he continued experimental research with both animals and humans. He then extended his learning experiments to dogs and also studied the mental life of three Cebus monkeys he kept in his New York city apartment (Bruce, 1997, p. 879). Thorndike spent the summers of 1899 and 1900 at the Biological Sciences Research Station at Woods Hole, Massachusetts, where he conducted one of the earliest studies of learning in fish. At Woods Hole, Thorndike also met the renowned biologist Jacques Loeb (1859–1924) and the young comparative psychologist Robert Yerkes (Chapter 11). As the years passed, Thorndike's interest centered more and more on education. Perhaps the nature of his academic home influenced him, for Thorndike made it his custom "to fulfill my contractual obligations as a professor before doing anything else" (Thorndike, 1936, p. 270). But it surely was comparative psychology's loss that he did not continue his animal research. Instead, he devoted his time to education, becoming an authority on educational measurement and, with John Dewey, one of the leaders of the progressive education movement.

Thorndike's Mental Measurements

Thorndike recognized the reality and importance of individual differences. He believed that one of the great tasks of psychology was to develop techniques that would allow the measurement of such differences. He published a monograph entitled *Heredity, Correlation, and Sex Differences in School Abilities* in 1903 and *Introduction to the Theory of Mental and Social Measurements* in 1904. He opposed conceptions, such as that of Charles Spearman (1904), that emphasized "general intelligence." Thorndike thought of intelligence as a combination of a number of specific skills and abilities. He developed an intelligence test consisting of subtests to measure sentence completion (C), arithmetic (A), vocabulary (V), and ability to follow directions (D). This CAVD test was widely used at Columbia and many other institutions to measure students' skills and abilities. Thorndike believed that these subtests could measure different abilities that might or might not be correlated in a particular person.

With regard to the origin of individual differences, Thorndike was a convinced hereditarian (Thorndike, 1913), believing that genetic factors are of primary importance and that *systematic eugenics* is the only hope for the improvement of the human population. Genetic determination of individual differences in intelligence, he argued, must be accepted as a fact. Thorndike opposed educational egalitarianism. He proposed that different educational opportunities be provided for children of different levels of ability, since schools can do very little to modify a child's intellectual standing. On the other hand, he considered high intelligence a precious resource that should not be wasted through poor schooling. He often used dramatic examples to illustrate his points. Send 1 million English schoolboys on a voyage like that of *H.M.S. Beagle,* and how many of them, he asked, would make the discoveries Charles Darwin made? Not 1,000, not 100, not 10, perhaps not even 1. In these views he was very much a product of his times and also very different from his contemporary, John Dewey.

Thorndike's Applied Research

During his years at Teachers College, Thorndike also worked on a number of industrial problems: development of employee examinations for applicants for positions with the American Tobacco Company and selection tests for clerical workers. During World War I, he did much of the statistical analysis for the Army Testing Project (Chapter 11) and worked on the development of selection techniques for aviators. After the war, Thorndike successfully invested several thousand dollars in Cattell's Psychological Corporation (R. M. Thorndike, 1999) and was elected to the board of directors as a charter member.

Like Cattell, Thorndike favored a precise, quantitative approach to the assessment of psychological phenomena. Two examples of his work will illustrate his approach. With support from the Carnegie Corporation, Thorndike undertook to survey the quality of life in American cities. His results for 310 large cities were published in *Your City* (1939), and those for 144 smaller cities in *One Hundred Forty-Four Smaller Cities* (1940). He assembled a multitude of facts about each city's population; its educational and recreational facilities; the health of its inhabitants and their occupations; *per capita* expenditures for schools, libraries, and museums; incomes; crime rates; and other factors. These facts were then combined to yield a G score reflecting the city's general quality of life. Thorndike also combined a number of other measures—including number of high school graduates, literacy rate, library circulation, and homicide rate—to arrive at a P score for each city. He regarded P as a reflection of the intelligence, character, and personal qualities of the city's citizens. Thus, G was considered a measure of the quality of the environment, and P a measure of the genetic quality of the population.

A second line of investigation was inspired when one of Thorndike's children found it difficult to learn to spell, which led Thorndike to become interested in word usage. First he made counts of word frequencies in literature, textbooks, the Bible, newspapers, correspondence, and other written materials. From fifty different sources, Thorndike compiled a list of the ten thousand words that occurred most frequently (Thorndike, 1921). This list was expanded in 1932 to twenty thousand words (Thorndike, 1932). Among the five hundred most-used words were *and*, *apple*, *big*, *but*, *I*, *dead*, *man*, *most*, *near*, *no*, *now*, *open*, *pass, top,* and *sister.* Thorndike urged that teachers pay particular attention to teaching children to use and spell these words.

In 1931, Thorndike published a *Junior Dictionary,* and in 1940 the *Thorndike Senior-Century Dictionary.*[5] According to Thorndike's grandson, Robert M. Thorndike, himself a professor of psychology, a particular event led to these dictionaries: his grandfather found in a dictionary intended for young children the word *bear* defined as "a carnivorous plantigrade quadruped" (R. M. Thorndike, 1999). In his dictionaries, Thorndike established a rule—he always made a word's definition simpler than the word itself. His dictionaries enjoyed great success, with the *Junior Dictionary* selling more than 1 million copies. Thorndike was also interested in the more general question of language acquisition and formulated what he termed the "babble-luck" theory to explain how a child learns a particular language. According to this theory, the child first makes a wide range of babbles. Some of the sounds the parents recognizes and rewards. This is satisfying to the child, and so language is learned through trial and success (Thorndike, 1913).

Thorndike's Honors

Thorndike received many honors and awards. In 1912, he turned down an offer of a professorship at Harvard University and that same year was elected president of the APA. In 1917, Thorndike was elected to membership in the National Academy of Science, and in 1921 he was appointed research director of the Institute for Educational Research at Teachers College. In a 1921 poll of psychologists for his *American Men of Science,* Cattell found that Thorndike ranked first; in 1925, the board of trustees of Columbia University awarded Thorndike the gold Butler Medal in recognition of his contributions to education; and in 1933, he served as president of the American Association for the Advancement of Science.

Thorndike attracted many students and was often kind and generous with them and his coworkers. One of his students, Herbert Toops, named his first son Edward L. Toops and his second son Thorndike Toops in Thorndike's honor (Meyer, 1983, p. 2). Others, however, found him aggressive, abrasive, and domineering—behaviors that Thorndike himself described as the "bluff" he used to mask his shyness. He made a great deal of money from his books; in 1924, his royalties were five times his professorial salary, and he prospered even during the Depression years. His life as a psychologist seems to have been deeply satisfying. He retired in 1940, but his retirement years were often filled with sadness and melancholia. Thorndike suffered from arteriosclerosis, was deaf, and much of the time thought of himself as a "tired old man." He published nearly fifty psychological works after his retirement, but the joy and satisfaction had gone out of publishing. The habit persisted, but the satisfiers had lost their value. Thorndike died at the age of 74 on August 9, 1949, from a

[5] These dictionaries are published today as the *Thorndike-Barnhart Children's Diary,* the *Thorndike-Barnhart Junior Dictionary* and the *Thorndike-Barnhart Student Dictionary.* They are available on Amazon.com, where purchasers give them enthusiastic reviews.

massive cerebral hemorrhage. His name is known to most contemporary psychologists, but most often for the animal learning experiments he did at the very beginning of his career (Dewsbury, 1998).

CONCLUSION

Thorndike's death ends our consideration of functionalism. Today functionalism no longer exists as a formal school of psychology, and it would be impossible to point to a university as the home of functional psychology. However, the functionalists' point of view has been widely accepted and is now part of nearly all psychologists' frame of reference. Paradoxically, while there are few, if any, formal functionalists, nearly all psychologists are functionalists in that they are interested in mental functions as adaptations and adjustments to the environment. As a formal school of American psychology, functionalism was displaced early in the twentieth century by a more radical and aggressive movement—the *behaviorism* of J. B. Watson. Before we consider Watson's behaviorist revolution (Chapter 12), we will describe the development, use, and occasional abuse of intelligence tests during the early decades of the twentieth century. The story of attempts to measure this particular function of the human mind is fascinating and, at times, very sad.

Alfred Binet.
(National Library of Medicine)

CHAPTER 11

Historical Uses and Abuses of Intelligence Testing

The early decades of the twentieth century saw the first successful attempts to measure one particular function of the human mind: intelligence. As increasing numbers of children entered the public schools, the need for increased educational effectiveness became critical. In addition, differences in academic ability and motivation brought to prominence the need for efficient, objective, and inexpensive means of ability grouping. While the development and widespread application of intelligence tests was primarily an American undertaking, the first tests were developed in France, where an interest in the measurement of mental capacities dated back to Pierre Broca.

PIERRE BROCA'S CRANIOMETRY

In addition to his outstanding work on the localization of speech (Chapter 3), Pierre-Paul Broca undertook extensive measurements of the human body, including the head, in an attempt to understand its functions. Broca believed that brain size is a good general index of intelligence. He concluded that men are on average more intelligent than women and that this difference is greater in contemporary men and women than it was in the distant past. Broca's conclusions were based on two sets of data (Broca, in Gould, 1978, p. 44):

1. The results of his own autopsies in four Parisian hospitals. He collected data on 292 men's brains and 140 women's brains. The average weight of the men's brains was 1,325 grams, while that of the women's was 1,144 grams, a difference of 181 grams, or 14 percent of male brain weight.
2. Measurements of the cranial capacities of a number of prehistoric skulls. In those skulls, Broca found a difference of 99.5 cubic centimeters between male and female brains, with male brains larger. His measurements of contemporary brains showed volume differences ranging from 130 to 221 cubic centimeters. Broca concluded that the brains of primitive people were smaller than modern human brains and that sex differences in brain volume were increasing over time.

Testing Individual Differences in Ancient China

Ancient tests of individual differences were developed and used two thousand years before the first psychological tests described in this chapter. During the late Ch'in (Quin) and early Han periods in China (200–100 B.C.), examinations were developed and administered under the aegis of the Emperor of China. The examinations were written tests of literacy and were used as the basis of official recommendations for important positions in government service (DuBois, 1970). These imperial examinations fell into disuse but reappeared at the time of the T'ang dynasty (618–906). There followed a long developmental process. Bowman (1989) describes the result:

> By the time of the highly developed Ming dynasty (1368–1644), the examinations had become an elaborately formalized social institution. They included different levels of examinations (municipal, country, provincial, and national) that were further differentiated and associated with the granting of formal titles, including some loosely analogous to modern university degrees. At each level, success yielded further titles and access to more power in the civil service. For long periods this system worked quite efficiently, and modern scholars believe it was successful in ensuring a steady supply of talented men from the provinces for service in the national government (Kracke, 1963), forming a power group the emperor controlled as a counterbalance to the hereditary aristrocracy. (Bowman, 1989, p. 577)

Proficiency in music, archery, horsemanship, arithmetic, and knowledge of the ceremonies of private and public life were examined. But most important were high levels of verbal ability, especially in constructing elegant, abstract arguments. Many candidates failed the examinations. Their troubles became a shared feature of life in the Ming dynasty and entered into the literature and folk stories of China.

Changes in these examinations over a period of some five hundred years foreshadow many of the developments and controversies in modern psychological testing (Chapter 11):

> Such topics as the relative importance of memory as a feature of mental ability, the role of expert knowledge, effects of social class on test performance, the use of examinations to provide opportunities for social mobility, personal recommendations as an alternative to formal examinations in personnel selections, social protest against the nature of the examinations, the use of geographical units in allocating quotas of candidates to be passed, and the need to measure applied problem solving and reasoning were all vigorously debated. Methods for dealing with such practical problems as cheating, plagiarism, and examiner bias also had to be developed. (Bowman, 1989, p. 578)

Contemporary psychological tests originated with the work of Francis Galton, Alfred Binet, and Lewis Terman in the late nineteenth and early twentieth centuries. But the remarkable historical lineage of such tests goes back over two thousand years to the world of Ancient China.

Broca's conclusions must be questioned. He assumed that mature adults are more intelligent than the elderly, that "primitive" people were less intelligent than modern people, and that men are more intelligent than women. Each one of these assumptions was unsupported, but once he accepted them, it seemed logical to Broca that any differences he found in the brain sizes of these groups would be a reflection of corresponding intellectual capacities. His reasoning was surprisingly circular for a scientist of his stature. Why did he not question his original assumptions? The answer may lie in an examination of his social context. Broca's basic assumption that men are more intelligent than women was a prevailing view at the time. We saw Galton's views of male superiority in Chapter 9. Such views were also common in France, as is evident from the following attack on women, and incidentally all non-Parisians, by one of the leaders of nineteenth-century French psychology, Gustave Le Bon (1841–1931):

> In the most intelligent races, as among the Parisians, there are a large number of women whose brains are closer in size to those of gorillas than to the most developed male brains. This inferiority is so obvious that no one can contest it for a moment; only its degree is worth discussion. All psychologists who have studied the intelligence of women . . . recognize today that they represent the most inferior forms of human evolution and that they are closer to children and savages than to an adult civilized man. They excel in fickleness, inconstancy, absence of thought and logic, and incapacity to reason. (Le Bon, quoted by Gould, 1978, p. 46)

A second aspect of his cultural and intellectual environment might also have influenced Broca's thinking: the rise of Charles Darwin's theory of evolution. Broca was the founder and leader of a small group of French "freethinkers" who accepted Darwin's theory of evolution. "I would rather," Broca said, "be a transformed ape than a degenerate son of Adam" (Sagan, 1979, p. 6). Broca developed a primitive form of social Darwinism to account for the apparently increasing difference in brain size between men and women over time. He believed men are involved in a struggle and competition for survival; they are active in meeting the demands of their environments and protecting their families; and so bigger brains have been selected for in men. Women, Broca thought, are protected, passive, largely sedentary, and restricted to the family situation, and so they were not subject to the same selection pressure.

Many regarded Broca's works as jewels of nineteenth-century science. Thomas Huxley (Chapter 9) said that the mere mention of Broca's name filled him with a sense of gratitude for what Broca had accomplished. Broca's work measuring brain size was often cited in opposition to extending higher education and the right to vote to women. After all, if women are the most inferior forms of human evolution, with brains more similar to gorillas' than to men's, why should they be allowed to vote (Chapter 2) or to enter universities? In 1776, Abigail Adams urged her husband John to lead Congress in considering the question of the independence and education of women (Smith, 1976, vol. 2, p. 1809), although it was only in the middle decades of the nineteenth century that the first women's colleges were established and in the 1880s and 1890s that state universities became coeducational.

The battle was eventually won, but the struggle was long and difficult. All too often assumptions of male superiority and prejudice against women had blocked progress. Broca's findings and conclusions supported such prejudice. The pathos of that situation is further heightened by the falsity of his conclusions.

A modern biologist and historian of science, Stephen Jay Gould (1978), pointed out that one of the most important determinants of brain weight is age;

brain weights generally decrease with age. The women whose brains Broca studied were older than the men, but Broca did not take that fact into account in analyzing the differences in brain weight he found. When Gould reanalyzed Broca's data and controlled for age differences, he found that the difference in brain weight between the male and female brains was reduced from 181 to 113 grams. Other important influences on brain weight are cause of death and body size. After taking these factors into account, Gould concluded:

> Thus, the corrected 113-gram difference is surely too large: the true figure is probably closer to zero and may as well favor women as men. And 113 grams is exactly the average difference between a 5 foot 4 inch and a 6 foot 4 inch male in Broca's data. . . . They certainly don't permit any confident claim that men have bigger brains than women. (Gould, 1978, p. 48)

Gould was also able to demonstrate the invalidity of Broca's claim that the difference in volume between contemporary male and female brains is larger than in brains from prehistoric times. Gould found that it was based on only seven male and six female prehistoric skulls. To draw conclusions on the basis of such a small sample was a serious error of judgment by Broca.

Pierre-Paul Broca died in 1880. The brains he had studied became part of the Musée Paul Broca (Broca's Museum), which later merged with the Musée de l'Homme (Museum of Man) in Paris. In a musty back room of the Museum of Man, Carl Sagan (1979) found shelf upon shelf of bottles containing human brains. The label on one of them read "P. Broca." Broca's brain had been preserved as part of the collection he had established more than a hundred years earlier.

True progress in measuring intelligence would not come from Broca's craniometry, or from attempts such as those of Galton and Cattell to use physical measures of mental functions (Chapter 9), but from the work of another Frenchman, Alfred Binet.

ALFRED BINET (1857–1911)

Binet's Early Life and Education

Binet's greatest contribution to psychology was developing the first psychological scales to assess intelligence. His scales quickly supplanted earlier attempts to measure intelligence using physical measures and replaced subjective judgments and characterizations. We often assume that people we know differ in their mental abilities, but it is difficult to specify the criteria we use in making such judgments. Some people just "look" bright or dull, or perhaps they have the "right" shape of head (echoing the phrenologists discussed in Chapter 3). However, scientific attempts to use such criteria to assess intelligence have always proved futile. Many people whose professions require them to evaluate others—teachers, personnel directors, and the like—develop their own informal ways of evaluating intelligence. Some of their judgments may be acute, but they are also prone to error and prejudice and are especially troublesome when the person making such judgments has total confidence in them. Binet's great contribution was to replace such informal, subjective appraisals of intelligence with standard, uniform, objective methods.

Alfred Binet was born in Nice, France, on July 11, 1857, the only child of a physician father and a mother who had modest artistic talents (Wolf, 1973). Binet's parents separated when he was young, and he was raised by his mother. Binet first studied law and then followed the family tradition of medicine; both his grandfathers had, like his father, been physicians. A trip to a mortuary led Binet to end his medical studies and concentrate on psychological works. He had an independent income and so was able to pursue his interests without the pressure of earning a living. He read Francis Galton's *Hereditary Genius* (1869), Charles Darwin's *The Expression of the Emotions in Man and Animals* (1872), and the works of John Stuart Mill (Chapter 2). Binet once stated that Mill was his only teacher of psychology (Wolf, 1964, p. 762). Binet was a self-taught library psychologist. Such an education suited Binet, for he was an introverted person who had few friends and did not enjoy meeting people. The disadvantage of such an education was that it deprived Binet of two of the advantages of a university education—interactions with others and training in critical thinking. Interaction with other students and with skilled faculty members weakens the power of the printed word and teaches a student to test and evaluate ideas, approaches, and assumptions. In the careers of many psychologists we see the influence of great teachers. In his solitary education, Binet lacked such influences. Within a few years, he was to pay a very heavy price for uncritically accepting the views of others (Wolf, 1973).

Binet's Early Years with Jean Charcot at La Salpêtrière

The years of solitary reading and study ended in 1883 when Binet's former schoolmate Joseph Babinski, the man who thirteen years later was to discover the infant reflex that bears his name, introduced him to Charles Féré. Féré in turn, introduced Binet to his supervisor and the director of La Salpêtrière, Jean Charcot (Chapter 8). Binet was pleased to accept Charcot's offer of a staff position at the clinic and spent seven years there with Charcot as his mentor and Féré as his coworker.

Charcot was world-famous for his demonstrations of neurological and hypnotic phenomena. His clinic at La Salpêtrière was known as the "Mecca of neurology and hypnosis." Binet was dazzled by Charcot's reputation, called him "the master," and accepted without question his views on hypnosis. Charcot had described three distinct hypnotic states: lethargy, somnambulism, and catalepsy. He also believed that persons who could be hypnotized had unstable or deteriorated nervous systems. How did Charcot know they had such nervous systems? He knew because they could be hypnotized. Why could they be hypnotized? Because they had unstable or deteriorated nervous systems. Binet never challenged such circular reasoning and accepted Charcot's views unconditionally.

Binet and Féré used hypnosis in their experiments at La Salpêtrière and claimed to have discovered a new and startling phenomenon they labeled *transfer.* They reported that in hypnotized patients, an act such as lifting an arm could be moved or transferred from one side of the body to the other by the action of a magnet. Women were most often the subjects in their demonstrations (Winter, 1998). In one demonstration with their most compliant subject, 'Wit':

> They asked 'Wit' to thumb her nose at a bust of Gall with her *left* hand; this she did several times. However, with the magnet hidden near her right side, her left-hand gestures became attenuated as if atrophied. The right hand trembled and the left was still. 'Wit' became restless; she looked at the bust and called it "disgusting"; she scratched her left ear with her right hand, and then forthwith thumbed her nose at the bust of Gall with that hand. (Binet & Féré, 1885, in Wolf, 1964, p. 764)

In a similar manner, claimed Binet and Féré, visual, auditory, and tactile sensations could be magnetically transferred from one part of the body to another. They also reported what they called perceptual and emotional polarization. In perceptual polarization, the polar opposite of an existing perception could be induced by a magnet: a red cross hallucinated on white paper would turn green when the magnet was brought near. In emotional polarization, the magnet produced an opposite emotion: a hypnotized patient showing intense fear of a piece of rubber she had been told was a snake caressed and even showed affection for the "snake" under the magnet's influence. Fear and withdrawal had been polarized into affection and approach. Binet and Féré described transfer and polarization as marvelous, totally unexpected findings of capital importance and inexplicable by conventional neurological theories. They believed that the magnetic field produced the effects and claimed that these effects were as reliable and easily demonstrated as the magnetic phenomena of the physical world.

Other investigators, however, were not convinced. Ambrose-Auguste Liébault (1823–1904) had practiced hypnosis in the French town of Nancy since 1864 (Chapter 8). He had cured some physical illnesses using hypnosis and accepted the reality of certain hypnotic phenomena, but not the ones Binet and Féré reported. In December 1885, he visited La Salpêtrière and was appalled by what he saw. Patients in the experiments had full knowledge of the expected effects, and many of the demonstrations were done on the same patient, an attractive, compliant woman nicknamed "Wit." She was, in fact, Binet and Féré's "Exhibit A." The experiments were poorly controlled and carelessly conducted. Liébault returned to Nancy and tried many times to obtain transfer and polarization in his own patients, but always without success. The critical difference between his experiments and those at La Salpêtrière was that his patients did not know what was expected or when the magnet was moved. He was convinced that suggestion alone had accounted for Binet and Féré's results. Their patients knew what was expected and when the effect was supposed to occur, and they complied. Liébault also disputed Charcot's claim of a link between hypnosis and disordered nervous systems and especially Charcot's dictum that hysteria and hypnosis are always associated with each other. Some of Liébault's hysterical patients were difficult to hypnotize; their hysteria was a barrier to hypnosis. On the other hand, many strong, robust, obviously sane patients were easily hypnotized. Thus, Liébault concluded that susceptibility to hypnosis bore little relationship to hysteria.

Liébault alone was a formidable opponent, but the critical chorus grew louder in 1888 when Hippolyte Bernheim (1840–1919), the leader of the hypnotists in Nancy, published a second edition of *Hypnosis and Suggestibility in Psychotherapy*. In 1885, he had traveled to Paris and, like his colleague, been disturbed by what he observed. He accused the Salpêtrière researchers of a series of errors, especially of ignoring the influence of suggestion in their experiments. Bernheim stated that transfer and polarization could not be demonstrated in patients who were unaware of the expected effects. He also rejected the link between hysteria and hypnosis and the description of three separate forms of hypnosis.

Binet and Féré responded to these criticisms with a long series of tense, dogmatic, unyielding rebuttals. Failure to replicate their results, they said, was due to the general ineptness of the Nancy hypnotists and their inability to replicate the experimental conditions exactly. Binet and Féré claimed to have replicated their findings thousands of times under the most carefully controlled conditions. They stated confidently that there was no possibility that their results were due to suggestion. Rather, they were due entirely to the magnet's power, and to question them was to doubt all magnetic phenomena, including those of the physical world. Binet and Féré even disputed the ability of the Nancy researchers to hypnotize their patients, leading Bernheim to reply sarcastically that it seemed only the Parisians had access to "profound hypnotism," while all others had to be content with a "petty hypnotism of the provinces."

The final blow to Binet and Féré came when the Nancy workers reported that they had been able to produce both transfer and polarization in nonhysterical patients simply through suggestion and without the use of a magnet. In a most painful and humiliating manner, Binet and Féré were forced to admit that they had been wrong. In 1892, Binet wrote this anguished summary of his hypnosis experiments at La Salpêtrière:

> At first, when these studies on hypnosis were returned to an honorable place by M. Charcot, there was a great movement of enthusiasm. Since then, we may as well admit it, the enthusiasm has diminished; it has often been recognized that these studies present a host of causes of error, which very often falsify the results without the knowledge of the most careful and prudent experimenter, and no one can say that he has never made a mistake; one of the principle causes of unceasing error . . . is suggestion, that is, the influence of the operator by his words, gestures, attitudes, and even silences. (Binet, 1892, pp. 67–68)

Binet had staked his reputation on these results; his humiliation in having to admit that they were due to suggestion can easily be imagined. It is a pleasure to be able to report he was able to salvage his career from the wreckage of the years at La Salpêtrière and to make many important contributions to psychology, including, of course, his intelligence tests. However, Wolf (1973) showed that Binet was scarred by this experience. His collaborator in developing the intelligence tests, Théodore Simon, recalled that Binet never spoke of his years at La Salpêtrière and rarely mentioned Charcot's name. His concern with the effects of suggestion became almost obsessive. In 1900, he published a 338-page work called *La Suggestibilite.* Binet described suggestion as "the cholera of psychology" and often warned, "tell me what you are looking for and I will tell you what you will find" (Tuddenham, 1974, p. 1072). His concerns and warnings were clear anticipations of later concerns among psychologists about experimenter effects (Rosenthal, 1966) and the demand characteristics of psychological experiments (Orne, 1962). Binet became increasingly withdrawn and rarely attended meetings of psychologists. G. Stanley Hall (Chapter 10) invited him to the 1899 (10th anniversary) and 1909 conferences at Clark University, but Binet declined both invitations. He expressed the dark side of his personality by writing and producing Gothic plays with melodramatic themes of terror, murder, and psychopathology; four of his dramas were staged in Paris and met with modest success.

Binet's Research on the Development of Cognition

Binet resigned from the Salpêtrière clinic in 1890 and was then without a professional position. Fortunately, he had an independent income. His interests turned toward his own family and especially to developmental studies of his children, Madeleine and Alice (Varon, 1935). At the time, Madeleine was 4½ years old and Alice 2½. Binet was struck by the individual differences between them: Madeleine always concentrated firmly, whereas Alice was more impulsive; Madeleine was often silent, cool, and controlled, whereas Alice was gay, usually laughing, giddy, and turbulent. In 1890, Binet published three papers describing his observations, using the pseudonyms Marguerite and Armande for the girls. He stated that the girls recognized objects represented by simple line drawings and were able to describe the uses of everyday objects. Binet also devised a number of tests of his daughters' thinking. He asked Madeleine which of two piles of coins, beans, or tokens contained more. Binet found that Madeleine judged not in terms of the number of objects, but in terms of the space on the table they covered; the more space a pile covered, the more likely she would identify that pile as containing more objects. In another test, Binet showed Madeleine a number of familiar objects and then took them out of sight. When more than five objects were shown, removed, and then brought back one by one, Madeleine always reported that there were more than there actually were. Binet's experiments with his daughters anticipated Jean Piaget's mid-twentieth-century research on the development of cognition in children. Binet's death in 1911 deprived Piaget of the opportunity of working with him. However, Piaget did work in 1920 in the laboratory school of Binet's collaborator Simon (Elkind, 1974, p. 14). There Piaget analyzed the "wrong" answers children regularly gave to questions on intelligence tests. He was surprised to find that the responses fell into patterns that differed according to the children's ages. Returning to Geneva's Rousseau Institute, Piaget devoted his life to studying the development of cognition (Gerow, 1988, p. 53).

Binet at the Sorbonne

In 1891, Binet joined the Laboratory of Physiological Psychology at the Sorbonne, working without salary until 1892, when he was appointed associate director. In 1894, he assumed the laboratory's directorship. At the Sorbonne, Binet conducted many research studies and published prolifically. One can only assume that his driving energy and dedication to psychology allowed him to do this, together with the fact that for Binet "one of my greatest pleasures is to have a piece of white paper to fill up. I work as naturally as a hen lays eggs"

(Wolf, 1973, p. 34). His research can best be described as *functionalist* studies of individual psychology: the perception of inkblots; memory, imagery, and creative and imageless thought; handwriting; and the reliability of eyewitness testimony. He also described children's fears and the effects of fatigue on workers. In addition to directing the Sorbonne laboratory and doing his own prolific research, Binet served during these years as director and editor-in-chief of the leading French journal of psychology, *L'Année Psychologique* (*The Psychological Journal*), founded in 1875. Binet solicited and edited the contributions of others, published hundreds of pages of his own writings, and even attended to the journal's often trying business affairs.

Binet's Test of Intelligence

The last decades of the nineteenth century were a period of great change in French education. On March 28, 1882, a law was passed that established mandatory primary education "for children of both sexes from 6 to 14 years old" (Schneider, 1992, p. 112). Universal education created a serious challenge: how to select students to proceed to the next educational level. By the end of the nineteenth century, a national system of examinations had been established in France to select and screen students for secondary and university education and for a growing vocational school system. The intensity of the selection is evident from the 1928/1929 figures. During these years, 4 million French schoolchildren were in the primary grades, 291,000 in secondary schools, and 70,000 in universities. At that time, the ratio of inhabitants to university students was 969 to 1 in France, compared with 290 to 1 in the United States (Schneider, 1992, p. 129).

The national educational authorities also faced the problem of educating "abnormal" children who were unable to learn in school. In 1899, Binet was invited to become a member of the newly founded Société Libre pour l'Étude Psychologique de l'Enfant (the Free Society for the Psychological Study of the Child). The word *free* in the Society's name was significant, for the founding group of teachers, principals, and physicians hoped to free themselves from the old pedagogy and begin scientific studies of children. As a member of the Society, Binet had access to children in public schools, an important consideration since his notoriety after the Salpêtrière years had caused many schools to bar him. That same year, Théodore Simon, a young medical student, nominated himself to be Binet's research assistant. He became Binet's most important collaborator, working with him on the intelligence tests that bear their names.

In 1899, the members of the Society launched a campaign to persuade the French Ministry of Public Instruction to do something about retarded children in the schools. In 1903, the ministry, as bureaucracies are prone to do, appointed a commission to study the problem. Binet and fifteen other people, many of them members of the Society, were appointed to this Commission for the Retarded. In 1904, the commission resolved unanimously that children in the schools judged by their teachers to be "refractory to education" should be given a "medico-pedagogical examination" and, if found educable, placed in a special class annexed to a regular school or in a special establishment. But what should the "medico-pedagogical examination" consist of? Binet defined the problem as:

> Establishing scientifically the anthropometric and mental differences that separate the normal child from the abnormal: of making these differences exact, of measuring them in some way so that their assessment ceases to be a matter of tact and intuition, but rather becomes something objective and tangible. (Binet, 1904, p. 408)

Binet set out to measure such differences. He described his methods in 1903 in his masterful book *Experimental Studies of Intelligence.* He used a number of tests:

1. Association tests, in which a child was given twenty-five to thirty words and asked to describe a related idea each word aroused
2. Sentence completion tests similar to the ones Ebbinghaus used (Chapter 6)
3. Themes on a given topic
4. Picture descriptions and memory tests
5. Object drawing and description
6. Digit repetition and other memory and attention tests
7. Tests of moral judgment

Binet and Simon developed twenty such tests and also investigated other possible measures of intelligence and the relationships between them. Simon wrote his thesis on Broca's craniometry and head measurements, concluding that such measures were of little value in assessing intelligence. Binet and Simon also considered graphology, or the study of handwriting, concluding that it was of some value but that more was needed to truly measure and evaluate intelligence.

In 1905, Binet and Simon published a number of papers in *L'Année Psychologique* describing a new scale for the measurement of intelligence in children, the 1905 Binet-Simon scale. Their first paper gave what they described as a "rough sketch" of a new method to diagnose inferior states of intelligence. They gave a clear statement of their aim:

> Our purpose is to be able to measure the intellectual capacity of a child who is brought to us in order to know whether he is normal or retarded. We should, therefore, study his condition at that time and that only. (Binet, 1905, p. 191)

A second paper gave further details of their methods and the tests themselves. The scale was to be given under controlled conditions, which they were careful to specify, and was meant to measure general intelligence, which Binet considered the "fundamental faculty" to make correct judgments, show initiative, and adapt to circumstances. The 1905 scale included thirty tests arranged in order of difficulty. Each child passed as many tests as possible. Though they had given the tests to many Parisian schoolchildren, Binet and Simon did not consider the scale in any way a final test of intelligence or a solution to the problem of diagnosing retarded children. Rather, it was a beginning, a first step in investigating the nature of intelligence. Between 1905 and 1908, Binet and Simon gave the tests to large numbers of schoolchildren and to a small number of retarded children in the institution Simon supervised. They arranged the children in a hierarchical order based on their performance.

In 1908, Binet and Simon developed a revised scale. They retained fourteen of the original tests, dropped nine, and modified seven; in addition, they added thirty-three new tests. The tests were arranged according to age levels from 3 to 13. In this arrangement, Binet and Simon's guiding principle was that a child should test "at age"; that is, the average 5-year-old should score at a mental level of 5, and so on. If a majority, usually 75 to 90 percent, of the children in a particular age group passed a test, it was assigned to that age level. It is important to note Binet and Simon's use of the term *mental level* rather than the later, more common term *mental age.* The latter term was introduced in 1911 by a German psychologist, Louis William Stern (1871–1938) (Hardesty, 1976). Binet and Simon rejected the concept of *mental age* as it implied something endogenous, fixed, and similar to chronological age. They used the term *mental level* to emphasize change and fluctuation: a child's mental level, as measured by their tests, could change. They believed that even retarded children could raise their mental levels and devised a system of orthopedic training for the retarded that rivaled that of Maria Montessori for normal children. It was also Stern who introduced the mental quotient as a ratio of mental age to chronological age (Stern, 1912). A score below 1 was an indicator of retardation, and a score above 1 of superior intelligence. When multiplied by 100, the mental quotient yields an intelligence quotient (IQ). Binet and Simon strongly opposed the concept of IQ, feeling it would be misleading and even dangerous. When the 86-year-old Simon, then a "slight old man, bearded, bent, walking with shuffling steps" (Wolf, 1961, p. 245) was interviewed in 1959, he passionately described the IQ as "a betrayal of the scale's objectives" (Wolf, 1973, p. 203). Stern himself had a principled position as to the limits of standardized mental tests (Lamiell, 2002).

In textbooks on individual differences published in 1900 and 1911, Stern described Binet's method of testing as an excellent ideal, but he believed that the tests as they existed failed to provide a comprehensive characterization of a particular individual's functioning. In the last year of his life, Stern, at that time a professor of psychology at Duke University, wrote of the computed IQ:

> Whoever imagines that in determining this quantity he has summed up *the* intelligence of an individual once and for all, so that he may dispense with the more intensive, qualitative study, leaves off where psychology should begin. (Stern, 1938, p. 60)

Despite the opposition of Binet and Simon, and the reservations of its creator, the simple-to-compute IQ became the standard way of depicting performance on intelligence tests.

Shortly before Binet's death in 1911, a third, "still unfinished" revision of the Binet-Simon scale was published. It differed from the earlier ones only in its details. The tests were now arranged to test mental levels from 3 to 15 years, and there were five tests for adults. Scoring was modified to allow credits for each test a child passed above a basal year, a change that Binet accepted reluctantly. He was too sophisticated to believe that intelligence could be parceled into fractions of mental levels.

The Binet-Simon scales provided what psychologists had long sought: a way to measure intelligence that was easy to administer and reasonably brief. The scales were an immediate success. Twenty-two thousand copies of the 1908 scale were distributed in three years, and fifty thousand copies of the 1911 revision were distributed in five years. By the outbreak of World War I in 1914, the tests were being used in at least a dozen countries. Often the scales were simply translated without any attempt to standardize them for the new setting. Intelligence testing was an idea whose time had come, and the imperative to use the scales was overwhelming. Binet's death at the age of 54 in 1911, together with the disruption the war caused, prevented Binet and Simon from making the later revisions of the scales they would certainly have made.

Instead of careful revisions of the original scales, intelligence testing developed in a way Binet did not anticipate and certainly would not have welcomed: mass testing of large numbers of adults and children. Before the end of World War I, 1,700,000 inductees to the United States Army had been tested; within thirty months of Lewis M. Terman's introduction of the Binet-Simon test in the United States, some 4 million children had been tested. The time lag between Binet and Simon's first scale in 1905 and these large-scale testing programs was very short. These developments will be considered later in this chapter. However, before leaving Binet, we must mention two posthumous recognitions that surely would have pleased him. In 1917, members of the Free Society for the Psychological Study of the Child voted to change their name to the Alfred Binet Society, a fitting and appropriate memorial to a great psychologist. In November 1984, the editors of the American Association for the Advancement of Science's journal *Science '84* selected Binet's development of the intelligence test as one of the twenty most significant developments or discoveries in science, technology, and medicine of the twentieth century (Hammond, 1984, p. 9).

HENRY H. GODDARD (1866–1957)

Henry H. Goddard was one of two men primarily responsible for introducing the Binet-Simon scales to the United States, with Lewis M. Terman the other. Goddard's parents were devout, evangelical Quakers. Goddard received a "guarded education" at Quaker schools (Zenderland, 1998). He earned a Ph.D. in psychology at Clark University in 1899, having been encouraged and influenced by G. Stanley Hall (Chapter 9). While languishing in a dead-end position at a Pennsylvania teaching college, Goddard met Edward Johnstone, the superintendent of the New Jersey Home for 230 "feeble-minded" children in Vineland, New Jersey. In 1906, Johnstone created a position for Goddard as director of psychological research at Vineland. At Vineland, Goddard established the Research Laboratory for the Study of Feeble-Mindedness, the first such research laboratory established in the United States (Leland, 1993). There he became convinced that if the problem of diagnosing feeble-mindedness was to shift from psychiatry to psychology, two critical needs must be met: someone must establish a reliable way to distinguish between normal and feeble-minded children, and a reliable way to distinguish between different levels of mental ability in both normal and feeble-minded children. On a visit to Europe in 1908, Goddard met a number of psychologists. He did not meet Binet but was given a copy of the Binet-Simon intelligence test (Zenderland, 1998, p. 92). Binet's scales promised to meet both needs. Goddard translated the 1908 scale into English and made some small alterations, such as changing the names of coins

Henry Goddard atop the Great Pyramid of Giza.
(Archives of the History of American Psychology)

from *sous* to *cents.* However, all his changes were minor, and while his scales are sometimes called Goddard's revisions of the Binet-Simon scales, it is more correct to think of them as translations.

Goddard administered the translated scales to 400 children at Vineland and 2,000 children in the New Jersey public schools (Goddard, 1911b). They satisfied his psychometric needs. The scores of the children at Vineland generally agreed with their institutional records. The scores of the public school children were usually very different, although he did discover that an alarming number of public school children tested below their age norms; he also found a wide range of scores in both the Vineland and the public school children. Goddard was convinced of the scales' value, and from then on he was an enthusiastic advocate of intelligence testing. He saw a need for testing in the public schools and began courses at Vineland that trained teachers to administer and score the tests. When Binet's 1911 scale appeared, Goddard immediately translated it. Until Terman's ambitious 1916 revision of the Binet scale, Goddard's 1911 translation was the standard test instrument in the United States (Goddard, 1911a).

The Kallikaks

In 1909, Johnstone and Goddard were asked by the American biologist and eugenicist Charles Davenport to collect data on the heredity of feeblemindedness. The result was Goddard's investigation of the inheritability of intelligence: his study of the Kallikak family (Goddard, 1912). In his book *The Kallikak Family*, subtitled *A Study in the Heredity of Feeble-Mindedness,* Goddard recounted the real story of this family. The scientific background to this study of human inheritance consisted of experiments on plant inheritance conducted fifty years earlier by an obscure Austrian monk, Gregor Mendel (1822–1884). Mendel's experiments had produced a revolution in biology and provided the impetus for Goddard's work. Mendel came from a poor Austrian family, joined an order of monks to gain an education, and studied at the University of Vienna, intending to become a schoolteacher. He took the final examination twice, but failed both times. The examiners found his knowledge of physical science adequate but concluded that he was not fit to teach natural history and biology. One professor said of Mendel that "he lacks insight and the requisite clarity of knowledge" (Bronowski, 1973, p. 380). After he failed to qualify as a teacher, the order sent Mendel in 1853 to the monastery at Brno in Moravia, now part of Czechoslovakia, and assigned him to work in the kitchen garden. Mendel accepted the assignment willingly, for plants and animals had always fascinated him. The garden plants and animals became his "children," and he tended them with care and attention. Beginning in 1856 and continuing for eight years, Mendel conducted some of the most important experiments in the history of biology.

First, Mendel bred wild mice with albinos to see what color coats hybrids would have. But his fellow monks objected to the smelly mice, and the local bishop found breeding experiments vulgar for a monk. Mendel turned to honeybees. He hoped to combine the gentleness of a race of Italian honeybees with the greater industriousness of a German race. Unfortunately, what his breed-

Gregor Mendel.
(The Bettmann Archive)

ing experiment produced was a colony of highly aggressive, unproductive hybrid bees (Gould, 1982, p. 308), so Mendel turned to working with plants. Mendel later recalled with a chuckle, "I turned from animal breeding to plant breeding. You see, the bishop did not understand that plants have sex" (Henig, 2000, p. 16). His plant experiments were all done in the monastery's 120-foot-by-20-foot vegetable garden. Mendel studied the characteristics of the most common of all kitchen garden plants, the pea: blossom color, smooth or wrinkled seeds, green or yellow seeds, and most important, tall or dwarf plants. He studied 10,000 plants and 300,000 peas (Henig, 2000, p. 83). The results of Mendel's experiments established for the first time a valid set of principles of genetic inheritance. To illustrate Mendel's methods and conclusions, consider his experiments on the inheritance of plant height. First, Mendel bred a hybrid of tall and short pea plants by artificially inseminating short plants from tall ones. The hybrid peas bore seeds that he then planted. Existing genetic principles predicted that the resulting plants would exhibit a blend of the parental characteristics; that is, that they would be of medium height. Mendel's peas, however, were not of medium height—they were all over six feet tall. Next he bred the second generation by fertilizing the hybrids with their own pollen. Their peas were planted, and the resulting plants measured. In this generation, Mendel found a majority of tall plants, but a significant minority of dwarf plants no more than twenty inches tall. He guessed that height in pea plants is controlled by two factors, one contributed by each parent. Today we call Mendel's "factors" genes. If the two parental factors are different, Mendel assumed that one would be dominant and one recessive. His first generation of peas had shown the tallness factor to be dominant. However, in the second generation, one mating in every four should, on the basis of chance, have caused two recessive factors to come together and produce a short plant. If *A* represents the factor for tallness and *a* symbolizes the factor for shortness, with *A* being dominant, then of the four possible combinations *AA, Aa, aA,* and *aa,* only the last (*aa*) produces a short plant. This means three out of four, or a ratio of three to one, pea plants should be tall. Among the 1,064 second-generation plants Mendel measured, 787 plants were tall and 277 short, a ratio of 2.84 to 1. Similar ratios occurred for blossom color; the factor for white flowers was dominant over the one for purple flowers.

In 1856, Mendel presented a study entitled "Experiments on Plant-Hybridization" at a meeting of the local Society for the Study of Natural Science. The audience was large and initially attentive, but they did not ask questions nor engage in discussion about Mendel's results (Iltis, 1932, p. 179). Ten years later, Mendel tried again, publishing his results in the *Journal of the Brno Natural History Society,* where they achieved instant oblivion. Shortly thereafter, Mendel's career as an experimental biologist ended when he was elected abbot of his monastery. His administrative duties precluded further research, which was probably just as well, for his superiors were suspicious of his "tampering with nature." To be sure that his research would not have heretical effects, his fellow monks burned all Mendel's research papers and notes after his death in 1884.

Mendel's paper remained in obscurity for over thirty years until it was discovered and republished by a number of scholars. In 1902, William Bateson, a

Cambridge University biologist, published *Mendel's Principles of Heredity: A Defence.* Bateson became known as "the Monk's bulldog" due to the ferocity of his advocacy of Mendel. The Dutch botanist Hugo de Vries also published an account of Mendel's experiments. On a trip to Germany, Goddard read de Vries's 1900 report of Mendel's experiments. Mendel's genetic model became the impetus for Goddard's work on inheritance and intelligence. He was convinced that Mendelian principles would account for the inheritance of feeble-mindedness. The leap from pea height, seed or blossom color, and form to something as complex as human intelligence seems enormous. Mendel himself came to question the general applicability of his results, but to Goddard the possibility was quite reasonable. He was convinced that both high and low levels of intelligence are inherited, for he had read Galton's reports of hereditary genius (Chapter 9) and had also discovered that many of the brothers and sisters of the children at Vineland had themselves been judged feeble-minded and institutionalized. For further study, he sought a family. Goddard called the people he found the *Kallikaks.*

In 1897, a young girl, Deborah Kallikak, was admitted to the Vineland Institute at the age of 8. Fourteen years later, in 1911, she was tested with the Binet-Simon scale and found to have a mental age of 9 years, leading Goddard to classify her as a "moron," a term he introduced to psychology from the Greek *moros,* meaning "dull" (Burtt & Pressey, 1957).[1] Goddard described Deborah as:

> A typical illustration of the mentality of a high-grade feeble-minded person, the moron, the delinquent, the kind of girl or woman that fills our reformatories. They are wayward, they get into all sorts of trouble and difficulties, sexually and otherwise, and yet we have been accustomed to account for their defects on the basis of viciousness, environment, or ignorance. (Goddard, 1912, p. 11)

Goddard investigated Deborah's family background and traced her ancestry back to the American Revolution, when a soldier of good family, Martin Kallikak, Sr., had a "casual intimacy" with a feeble-minded barmaid which led to the birth of Martin Kallikak, Jr. After the war was over, Martin Senior left the Army and became a wealthy and respectable citizen. He married a "worthy girl" from a Quaker family, and they had seven children—the "good" side of the Kallikaks.

Martin Junior also married and had ten children—the "bad" side of the Kallikak family. Goddard investigated the children of both marriages, seeking evidence of their mental status. He concluded that none of the children of the Quaker woman was subnormal, while five of the children of Martin Junior were feeble-minded. In later generations, the difference between the two lines of the Kallikak family became even more striking. Among the 480 descendants of Martin Junior, Goddard claimed to have found 46 normal people, 143 who were definitely feeble-minded, 36 illegitimate births, 33 sexually immoral people, 3 epileptics, and 24 alcoholics. These people were horse thieves, paupers,

[1] Burtt (1980) recalled that Goddard first saw the word *moron* as graffito on a railroad car.

convicts, prostitutes, criminals, and keepers of houses of ill repute—the riffraff of society.

The 496 descendants of the marriage to the Quaker woman were very different: only three were "somewhat mentally degenerate people," two alcoholics, one sexually loose person, and no illegitimate births or epileptics. In this family line, Goddard found doctors, lawyers, judges, traders, educators, and landholders—the pillars of society. The differences between the two family lines could not have been more striking, and to Goddard they provided overwhelming evidence for the inheritance of degeneracy along classic Mendelian lines. Goddard wrote that the Kallikaks provided:

> As it were, a natural experiment with a normal branch with which to compare our defective side. We have one ancestor giving us a line of normal people that shows thoroughly good all the way down the generations, with the exception of the one man who was sexually loose and the two who gave way to the appetite for strong drink. This is our norm, our standard, our demonstration of what the Kallikak blood is when kept pure, or mingled with blood as good as its own. Over against this we have the bad side, the blood of the same ancestor contaminated by that of the defective mentality and bad blood having been brought into the normal family of good blood, first from the nameless feeble-minded girl and later by additional contamination from other sources. The biologist could hardly plan and carry out a more rigid experiment or one from which the conclusions would follow more inevitably. (Goddard, 1912, pp. 68–69)

Goddard's conclusion that feeble-mindedness is inherited was quoted widely (J. D. Smith, 1985). The Kallikaks were indeed different, and these differences were highlighted by Goddard's graphic language: Martin Junior is referred to as "Old Horror," and his descriptions of the poverty, licentiousness, degradations, and general horror of the lives of his descendants are reminiscent of something by Dickens. Even the name Goddard chose for the family is significant. Goddard (1942) claimed that *Kallikak* meant "the nameless one," but the Greek word *kalos* means "good" and *kakos* means "bad." The Kallikaks quickly became a feature of social science texts, with Goddard's results often presented in highly simplified summaries. As recently as 1955, a *General Psychology* text by Henry Garrett,[2] the chairman of Columbia's department of psychology for sixteen years and president of the APA in 1946, included a figure summarizing Goddard's results. Children in the "good" side of the family were depicted as worthy, Quaker types; children from the "bad" side were portrayed as little devils, complete with horns (Garrett, 1955, p. 65).

While no one expects to achieve Mendel's degree of control in studying the inheritance of human intelligence, Goddard's study of the Kallikaks was seriously flawed. In 1911, he presented his Kallikak study at a meeting of the New York branch of the American Psychological Association (Benjamin, 1991). The minutes of that meeting rather cryptically report that after Goddard's address "considerable discussion followed" (Hollingsworth, 1912). Goddard's investigation had numerous methodological and procedural weaknesses:

[2] In 1954, Garrett was the only academic psychologist to testify against school desegregation in the U.S. Supreme Court decision *Brown v. Board of Education.*

1. The whole study took just two years, which seems very short for a study of this magnitude and detail.
2. The research assistants who worked with Goddard were people interested in social problems, but they had little training in genealogical research or interviewing. They were inspired by Goddard's crusading zeal and knew the aims of his study, and thus might have been biased.
3. There was little objective testing of the family members, and conclusions about a person's intelligence were often inferences from passing observations. In many cases, the investigator was not even able to see a person who could not be found, was uncooperative, or was dead. For these people, the investigators relied on reports from family members, friends, neighbors, associates, pastors, and others. At other times, a person's occupation and standing in the community were used to estimate intelligence.
4. Criminal behavior and feeble-mindedness were often equated. If a family member had a criminal record, he or she was classified as feeble-minded.
5. Goddard's assumption that feeble-mindedness is caused by a single recessive Mendelian gene is implausible.
6. Finally, while the different environments of the two lines were described graphically, environmental influence was largely ignored. Goddard even went so far as to describe the environments of the two family lines as "practically the same." Clearly that was not the case. To cite two obvious differences, medical care and nutrition must have been very different. Such differences are reflected in the numbers of infant deaths: eight-two in the "bad" family and only fifteen in the "good" family.

In 1981, Stephen Jay Gould (1981) added another criticism of the Kallikak investigation, asserting that Goddard had tampered with at least five photographs shown in *The Kallikak Family* by adding crude dark lines to accentuate the unfavorable facial features of members of the "bad" side of the family. A photographic expert who examined the photographs stated:

> The harshness clearly gives the impression of dark, staring features, sometimes evilness, and sometimes mental retardation. It would be difficult to understand why any of this retouching was done were it not to give the viewer a false impression of the characteristics of those depicted. (James H. Wallace, Jr., quoted in Gould, 1981, p. 171)

Gould concluded that Goddard had been guilty of "conscious skullduggery" (Gould, 1981, p. 171). Raymond Fancher in his history of the IQ controversy (Fancher, 1985, p. 114) reported that several of Goddard's Kallikak photos had been "doctored," but more recently he proposed an intriguing alternative explanation (Fancher, 1987). Fancher found a press photograph of a 1920s Canadian sportsman that had been retouched in much the same way as the Kallikak photos had. The retouching was done before publication to avoid an impression of blank-facedness; that, rather than "conscious skulduggery," might have been Goddard's motive for retouching. In addition, since Goddard believed that the feeble-minded usually appear normal, he would have been unlikely to have retouched photographs so as to make the "bad" Kallikaks appear more depraved (Fancher, 1987, pp. 586–588). Fancher concluded:

> I would now suggest that any "evil," "sinister," or "retarded" qualities added to the Kallikak photos may lie more in the eye of the beholder than in the ulterior or dishonest motives of the retoucher. (Fancher, 1987, p. 588)

Finally, the most important of all the Kallikaks, Deborah, is shown in a frontispiece photograph in the Kallikaks wearing a long, white dress, reading a book with a cat on her lap—an attractive pose of a striking young woman.

Eugenic Sterilization

Goddard's study of the Kallikaks spawned a host of similar studies of the Jukes, the Hill Folk, the Nams, the Ishmaelites, and the Zeros—families reportedly showing high levels of social and intellectual degeneracy. Such "bad seed" families were all reported to be reproducing at over twice the rate of "normal" families. Though Goddard had found 480 "bad" Kallikaks and 496 "good" Kallikaks, he did not hesitate to publicize what he considered to be a genetic threat to the American people. He served on the Committee for the Heredity of the Feeble-Minded, which recommended that mentally defective people be sterilized. Goddard described male sterilization as being almost as simple as having a tooth pulled. He also served as the psychological consultant appointed by the Eugenics Section of the American Breeders' Association to report practical methods for eliminating "defective people" from the population of the United States. This committee recommended in 1914 that the "defective classes be eliminated from the human stock through sterilization." Such "defective classes" included the feeble-minded, paupers, criminals, epileptics, the insane, and the congenitally handicapped (Van Wagenen, 1914, pp. 186–187). These Draconian recommendations were made not by a fringe group of crackpots, but by a committee advised by such luminaries as Alexander Graham Bell; Walter B. Cannon, the famed Harvard physiologist (Chapter 9); and Robert Yerkes, Edward Lee Thorndike, and Lewis Terman, three of the most eminent psychologists of the day. This was the authentic voice of the scientific establishment, and it was heard.

Indiana passed the first state sterilization law in 1907. It called for involuntary sterilization of "confirmed criminals, idiots, imbeciles, and rapists." During the next twenty-one years, twenty additional states were to pass laws permitting eugenic sterilizations (Karier, 1976, p. 345). In 1927, a Supreme Court decision upheld sterilization legislation. Most social scientists of the time considered such laws to be reasonable as well as reformist (Degler, 1991, pp. 45–46); the "progressive" states of the North and West were the first to pass such legislation. Of some 12,000 sterilizations in the United States before 1930, 7,500 took place in California (Scarr, 1993, p. 462). Southern states followed. Between 1924 and 1972, some 8,300 sterilizations were performed in Virginia.[3] In North Carolina 7,600 people were sterilized against their will (Zitner, 2003).

[3] In 2002, the Governor of Virginia expressed "profound regret" for one of those sterilizations. Raymond W. Hudlow was surgically sterilized for being "mentally defective." Hudlow served in combat in World War II, winning the Bronze Star and a Purple Heart for his bravery (Baskervill, 2000). Similar apologies have been issued by the governors of Oregon, where 2,600 people were sterilized, North Carolina, and California (Zitner, 2003).

Many of these laws remained in place until the 1960s, and one survey concluded that "the numbers would be staggering to the imagination if we knew exactly how many [people] were sterilized nationwide" (Nelson, 1980).

Reports of sterilization appeared regularly in the psychological journals of the 1920s and 1930s. In general, the articles described the positive outcomes of the sterilization of mentally and socially "defective" people. Goddard reported that he had not observed a single bad consequence following sterilization. It was quickly becoming the procedure of choice for many mental and social problems. When the German sterilization law was passed in 1933, an editorial in the American journal *Eugenical News* praised the Reich for leading "the great nations of the world in the recognition of the biological foundations of national character" and noted that the German sterilization law "constituted a milestone which marks the control by the most advanced nations of the world of a major aspect of controlling human reproduction, comparable in importance to the state's legal control of marriage" (editorial, quoted by Tucker, 1987, p. 288). The end result of this milestone was tragic: over 6 million people would be systematically slaughtered in the Holocaust.

Goddard at Ellis Island

A second threat to the integrity of America's genetic health was seen in the flood of immigrants entering the country in the decades before and after the turn of the century. America, the self-described "gathered nation" of peoples from many countries, was viewed from afar as the land of opportunity. At the turn of the century, trans-Atlantic fares suddenly became cheap as steamship companies competed for passengers in price wars, much as today's airlines often do. In the 1890s, the steerage steamship fare was halved from $20 to $10 (Macrae, 1992, p. 42). America was within reach, and millions of people answered the call.

Year	No. of Immigrants to the United States
1898	229,000
1901	497,918
1905	1,000,000+
1906–1913	1,000,000 per year

In 1910, the population of the United States was 76,000,000, of whom nearly 23,000,000 were foreign-born (Smith, 1985, vol. 7, chapter 8, *The Immigrants*). One of these immigrants recalled his experience in America:

> Well, I came to America because I heard the streets were paved with gold. When I got here I found out three things: first, the streets weren't paved with gold; second, they weren't paved at all; third, I was expected to pave them. (*Columbus Dispatch,* September 26, 1999, "The Ellis Island Museum")

For many of these immigrants, America fulfilled its promise, but for some "native" or "old" Americans—that is, people whose families had been here for

"Immigration Restriction Policy Wanted." A 1903 *Philadelphia Inquirer* cartoon supporting restrictive immigration laws.
(Courtesy of the New York Public Library)

more than one generation—the flood of immigrants raised fears that the country was being swamped and undermined by socially and mentally defective people. President Roosevelt appointed a Commission on Immigration to review the situation. They issued a forty-two-volume report showing that, in addition to the increased numbers of immigrants, there had been a clear shift in their countries of origin. Prior to 1900, most had come from Northern and Western Europe; the more recent immigrants were from Eastern and Southern Europe. They came from Italy, Poland, Lithuania, Estonia, Greece, and Turkey and also included people unknown to many Americans—Magyars, Serbians, Montenegrins, Croatians, and Slavs (P. Smith, 1985, vol. 7, p. 127). They were different and so were subjected to ethnic and national prejudice. A prominent social scientist, Frederick Jackson Turner, asserted in 1901:

> It is obvious that the replacement of the German and English immigration by southern Italians, Poles, Russian Jews, and Slovaks is a loss to the social organism of the United States. The congestion of foreigners in localities in our great cities, the increase in crime and pauperism, is attributable to the poorer elements. All these are presented by this transformation of our immigration. (Turner, quoted by Wattenberg, 2002)[4]

[4] From a Public Broadcasting System documentary entitled "The First Measured Century." Transcripts are available on the PBS website.

Immigrants who were able to find employment were feared, for it was claimed they would provide an impetus for the development of unions, which would threaten the American economic system (Blum, 1978). Such views were based on prejudice and a gangplank view of immigration—"I'm ashore, so pull up the gangplank"—but they were widely shared and politically potent. In addition, most of the new immigrants were Catholics, arousing fear that these members of the "Pope's legions" would undermine traditional religions in the United States. Finally, it was claimed that many of the new immigrants were mentally defective, the "wretched refuse" of Europe washing onto America's shores. With as many as ten thousand immigrants arriving every day, how were "defective people" to be recognized and deported? The immigration inspectors working in the Registry Room or "Great Hall of Judgment" on Ellis Island marked thousands of people as excludable from the United States. They used an alphabet of obstacles: H for heart problems, Pg for pregnancy, X for mental retardation, and X with a circle round it for insanity. As many as 2 percent of the immigrants were denied entry and sent back to their native lands (Bass, 1990, p. 91). But that number was not enough to assuage fears that the country was being overrun. In 1882, Congress passed a law forbidding lunatics and idiots to enter the United States, but how were the immigration agents to detect these people among the great mass of humanity arriving every day? Additional measures were needed to ensure that undesirables were not slipping through Ellis Island's[5] golden door. Heart problems and pregnancy the inspectors could often detect, but how to uncover retardation and insanity? One such possibility was the use of psychological tests.

In 1910, the commissioner of immigration invited Goddard and Johnstone to Ellis Island to study immigrant-screening procedures. Goddard's first visit was disappointing, since a fog in the harbor had delayed the ships and none of the expected five thousand immigrants arrived. Goddard did see one hundred earlier arrivals. They had completed their interviews, inspections, and medical examinations without being tagged with the dreaded chalk-deportation X and were about to leave. Goddard asked that they be lined up for his inspection. He walked down the line and selected one young man he judged to be mentally defective. Through an interpreter, Goddard gave him the Binet test. The man tested at the mental age of 8, apparently confirming Goddard's selection. The interpreter, however, protested that the test was unfair as the questions were unfamiliar. He argued that he would not have been able to answer them when he had first entered the country. Goddard firmly disagreed. The commissioner was impressed by Goddard's ability to pick out a mentally defective person and have a psychological test "confirm" his selection. Perhaps others could be trained to make such selections. The commissioner invited Goddard to return to Ellis Island.

Goddard stationed one of his assistants to review the immigrants as they walked by, and she picked out nine people as "defective." On the Binet test, all

[5] Ellis Island is now a national museum. On its magnificent site on an island in New York Harbor, the museum offers a moving record of the immigrant experience. A photographic narrative of Ellis Island appears in a paper by T. A. Bass, "A New Life Begins for the Island of Hope and Tears," *Smithsonian Magazine,* June 1990. The view of the Manhattan skyline bereft of the World Trade Center makes the site even more poignant.

nine scored below normal. Again the commissioner was impressed and invited Goddard and his coworkers to return for a more extended period. This time they spent a week on Ellis Island. Goddard claimed they were able to detect 90 percent of the feeble-minded immigrants by looking at them. In a small number of cases, their selections were supposedly confirmed by psychological testing. Goddard concluded that psychological methods would

> . . . be of tremendous value in the immigration problem. . . . Using the psychological method of examining, the percentage of immigrants that would be picked out as defective would be much greater than now. (Goddard, 1913, p. 107)

Goddard's prediction was soon confirmed. Immigration inspectors on Ellis Island began to use "psychological methods," and the number of deportations of allegedly feeble-minded people rose dramatically. In 1913 and 1914, there were 350 percent and 570 percent more deportations, respectively, than there had been in the preceding five years (Williams, 1914). Thousands of people were refused admission to the United States because they appeared feeble-minded[6] or performed below average on the Binet test.

The immigration officials welcomed Goddard's work as a scientific solution of one aspect of the immigration problem. They increased his funding and asked him to continue his work on Ellis Island. Three members of his staff spent three months there in 1914, testing 178 people from a group of average steerage passengers who were about to enter the United States. Through interpreters, the immigrants were given the Binet and DeSanctis tests. In the latter, the person was asked such everyday questions as "What is Crisco?" and "Who is Christy Matthewson?" They were shown a picture of a tennis court without a net and asked what was missing, and they had to fit geometric forms together on two board tests to demonstrate mechanical ability. The immigrants' performance was poor, especially on the Binet and DeSanctis tests—perhaps not surprisingly, given the language difficulty and cultural differences. How many Hungarians used Crisco, followed the New York Giants, or played tennis?

Goddard drew a very different conclusion. He reported that 83 percent of the Jews, 80 percent of the Hungarians, 79 percent of the Italians, and 87 percent of the Russians tested were feeble-minded (Goddard, 1917, p. 252). Such results seemed to confirm "that a surprisingly large percentage of immigrants are of relatively low mentality" (Goddard, 1917, p. 269). Restrictive immigration quotas were soon legislated, with Goddard's findings—together with those of other psychologists to be considered later in this chapter—providing scientific justification. Before considering this sorry and tragic aspect of psychology's past, we will briefly consider Goddard's later career and Lewis Terman's contributions to the development of psychology, especially psychological testing.

[6] Goddard believed that intelligent people were bright-eyed and alert. Some successful immigrants sent word back to others to pack a vial of *Belladonna* and to drop some in their eyes before meeting the inspectors. *Belladonna,* Italian for "beautiful woman," is atropine. It produces pupillary dilation, the wide-eyed look Goddard considered a sign of intelligence.

Goddard's Work with Gifted Children

Goddard left Vineland in 1918 for a position as director of the Ohio State Bureau of Juvenile Research. His annual salary of $7,500 made him Ohio's second-highest-paid civil servant—behind only the governor (Zenderland, 1998, p. 303). But Goddard's experience was unhappy. The Bureau was wracked by internal dissent; staff salaries, including Goddard's, were cut by 40 percent; and mass resignations ensued. Goddard left in 1922 for a position as a professor of abnormal and clinical psychology at The Ohio State University, remaining there until his retirement in 1938. During those years, Goddard studied children at the other end of the mental ability continuum: the intellectually gifted. Plans for the education of gifted children had been inaugurated in Los Angeles; Rochester, New York; and Cleveland. In Cleveland, Florence Hungerford, the general supervisor of schools, advocated special classes for very bright children. In those classes, children would be given freedom to explore a variety of enrichment activities under wise supervision (Sumption, 1941, p. xv). Hungerford secured the support of Mrs. Benjamin Patterson Bole, a leader of the Women's Club of Cleveland. Members of that club, many of whom were socially prominent, in turn provided volunteers and money to support the program. They also hired Goddard to spend two days a month as a consulting psychologist. Goddard held that position for the next five years. As a result of these efforts, in the 1920s the Cleveland public schools had one of the most extensive and progressive programs for the education of gifted children in the United States.

The Cleveland program began in October 1921 at Dennison Elementary School with twenty-five children from the 4th, 5th, and 6th grades. Identified by their teachers as exceptionally bright, those with IQ scores above 120 on an intelligence test were included in the program. In 1922, the program added classes in five more schools. By 1941, several thousand children had participated (Sumption, 1941, p. v). Their classes were referred to as Major Work classes to avoid any labeling or stigmatizing of the children. In *School Training of Gifted Children* (1938), Goddard described the Cleveland program. He advocated what he termed "enrichment," that is, expanded educational opportunities for gifted children, rather than rapid promotion schemes in which gifted children were promoted to higher grades. Goddard believed that gifted children would benefit most from being placed in special classrooms with other gifted children. Every effort should then be made to enrich their classroom experiences. In his book, Goddard described the children and many of their activities in detail. The activities are indeed impressive: full-scale theater productions, elaborate sculptures, intricate mathematical games, publication of a school paper, and always equal participation by girls and boys. Classrooms were informal, with no rules of silence or other regulations. A determined effort was made to show the children the culture and industry of Cleveland, at that time a heavily industrialized city of over a million people. So they took field trips to the zoo, the art gallery, the symphony, the *Cleveland Plain Dealer* newspaper, a Coast Guard station, docks, factories, and mills.

Seeing the children's photographs in Goddard's book, and reading about them, one wonders about the outcome of the program and what became of these students as adults. Evaluations of the Major Work program were con-

Henry Goddard: An Appreciation

Few early American psychologists have received as bad a press as Goddard (Fancher, 1998b, p. 473). Because of his infamous study of the Kallikaks, his support for laws restricting immigration to the United States, and the citation of his views on intelligence by racists, many critics have castigated him. In 1940, Knight Dunlap rejoiced that "Goddard's Kallikak study has been laughed out of psychology" (Dunlap, 1940, p. 221). Forty years later, Stephen Jay Gould dedicated his widely read book *The Mismeasure of Man:* "To the memory of Grammy and Papa Joe, who came, struggled, and prospered, Mr. Goddard notwithstanding." Gould characterized Goddard as "the most unsubtle herditarian of all" (Gould, 1981, p. 160).

Why, then, an appreciation? There is no doubt that Goddard's research and conclusions did harm to many. Goddard himself was no racist, and he aimed only to improve the lives of the feeble-minded he studied. He was widely liked by both students and faculty during his years at The Ohio State University (Burtt, 1980). His most famous student of all, "Deborah Kallikak," called Goddard, "her dear wonderful friend" (Zenderland, 1998, p. 359). Goddard was a modest person who often asserted that his proudest achievement was to have climbed the Matterhorn. At Ohio State he kept a photograph of that mountain over his desk. One of his colleagues, Harold Burtt, remembered his amiability:

> Goddard headed up our clinical program until he retired. He was rather mild and naïve. The students took advantage of him a lot. But he was an awfully nice person and a very nice guy to have around. (Burtt, 1980)

When asked by Terman to provide an account of his contribution to the Army Testing Program (later in this chapter), Goddard replied that it had been "Hardly worth mentioning. I think I supplied a few cigars and served as a subject in all the tests that the Committee tried" (Zenderland, 1998, p. 474). When asked to write his autobiography, Goddard refused with the wry comment that had he agreed to do so, the title would have been *As Luck Would Have It* (Zenderland, 1998, p. 1). In his later years, Goddard candidly acknowledged that much of his early work had been misguided and recanted his hereditarian positions. He feared for his historical reputation. Yet his work on the gifted stands the test of history. In 1998, Leila Zenderland published a comprehensive and fair-minded biography of Goddard. Fancher (1998b) labeled Goddard a "lucky biographee" and ended his review of Zenderland's biography with these well-chosen words:

> Whatever the unfortunate consequences of many of the ideas he espoused, Goddard was a basically decent person who—with his own particular mixture of strengths and weaknesses—was very much the creature of his friends, his time, and his circumstances. (Fancher, 1998b, p. 474)

ducted in 1929 and again in 1937. The children were given a number of achievement tests and their leadership and social skills were assessed:

> In actual achievement in terms of grade placement, the children are more than two years ahead of normal children of their chronological age. And further, these children are, in general, considerably ahead of grade placement for children of their intelligence quotients. Many teachers report the development of desirable social attitudes such as cooperativeness, consideration for others, leadership ability, and civic responsibility, as an outcome of the program.

> Development of self-control, judgment, and reasoning power is attributed to the program by other teachers. Still others mention the growth of imagination, initiative, originality, and resourcefulness. (Sumption, 1941, pp. 50–51)

In 1939, a questionnaire was developed to assess the life experiences of these men and women. In all, 263 of them completed questionnaires (Sumption, 1941, Chapters 4 & 5). Compared to students who attended regular school programs, Major Work graduates were found to have a wider participation in leisure-time activities and significantly wider and better reading interests. More Work graduates generally attended college, and unemployment was not a serious problem for them, a significant finding at a time of severe economic depression in the United States. They showed no differences in physical and mental health. A program of enriched opportunities for talented students had produced long-lasting positive outcomes. Goddard's career thus ended on a positive note, in sharp contrast with the methodological debacle of the Kallikaks and his unfortunate work on Ellis Island.

LEWIS M. TERMAN (1877–1956)

Terman's Early Life

Lewis M. Terman was born on an Indiana farm in 1877, the eleventh in a family of fourteen children. He entered school at the age of 6 and within six months was promoted to the third grade. Schoolwork came easily to the bookish Terman, but in most ways his life was no different from that of any other boy growing up in rural Indiana in the late nineteenth century. He was expected to help on the farm and spent summers working full time on the land until he was 18. Terman (1932) recalled that even as a boy he was interested in personality differences among his friends and schoolmates. He also found that through monotonous repetition of a phrase he could entirely lose his sense of personal identity and his orientation in time and space. Terman had discovered his *mantra.* When Terman was 10, a traveling book peddler sold his family a phrenology text. He spent a night with the family describing the new science of phrenology (Chapter 3) and reading their skulls. He predicted great things for Lewis Terman, whose interest in phrenology lasted until he was 15.

At some financial sacrifice, Terman's parents sent him to Central Normal College in Danville, Indiana, to prepare for a career as a schoolteacher. Terman was pleased to leave the endless chores, arduous plowing, and dull routine of farm life. He graduated in 1895, taught in a number of rural schools, entered Indiana University, and obtained an M.A. degree in 1903. One of Hall's former graduate students, W. L. Bryan, introduced Terman to Hall's writing and approach to psychology (Chapter 9). With Hall's support, Terman obtained a fellowship to Clark University in 1903. He delighted in Clark's free academic atmosphere: no majors or minors, no course requirements or formal lectures, no grades, and no examinations other than the final four-hour doctoral oral. At their first meeting, Hall reassured Terman by referring to his "splendid training" at Indiana and the "fine reports" he had received from his former teachers. Only later did Terman learn that such reassurances were a favorite device of the crafty Hall.

Lewis Terman (1877–1956), developer of the first successful American intelligence test.
(Archives of the History of American Psychology)

At first Terman worked under Hall, but when he decided to use mental tests in his thesis research, Terman was forced to change advisers. Hall disapproved of mental tests, distrusting what he termed their "quasi-exactness." Edmund Sanford, himself a Hall Ph.D., directed Terman's research. In his doctoral dissertation, "Genius and Stupidity," Terman compared seven "bright boys" and seven "stupid boys," seeking an explanation for their "precocity and stupidity." He graduated from Clark in 1905. Terman had developed tuberculosis and so sought a position in a warm climate. First he was the principal of a high school in San Bernardino, California; later he became a professor of child study at the Los Angeles Normal School, now California State University in Los Angeles. He remained there for four years before joining the faculty of Stanford University in 1910. Thus the Indiana farm boy became "a member of the faculty at Stanford University, the university that I would have chosen before any other in the world" (Terman, 1932, p. 323). Terman remained at Stanford for the rest of his career, serving as one of the university's most distinguished teachers and researchers and, as chairman, helping to establish one of the finest psychology departments in the world.

Terman's Revision of the Binet-Simon Scales

At Stanford, Terman began an investigation of the strengths and weaknesses of the Binet-Simon intelligence test that led him to revise the original scale.

Terman described his revision in *The Measurement of Intelligence* (1916). He dedicated the book: "To the memory of Alfred Binet: Patient researcher, creative thinker, unpretentious scholar; inspiring and fruitful devotee of inductive and dynamic psychology" (Terman, 1916, p. v). The book is a classic in psychology, although Terman was surprised by its favorable reception and psychologists' rapid acceptance of his revision.

In revising the Binet-Simon scale, Terman and his coworkers used a standardization sample of 2,300 people: 1,700 normal children, 200 "defective" and superior children, and 400 adults. Terman's was by far the most extensive and varied standardization sample to have been used up to that time. Besides the original Binet-Simon test items, Terman included ten additional items in the pool of potential test items from which the final revision items were selected. In selecting test items, Terman's aim was to arrange the different tests so that the median mental and chronological ages of a group of unselected children would coincide: the average child of 10 should test at the mental age of 10, the average child of 12 should test at the mental age of 12, and so on. Terman found many of the test items from the original Binet-Simon scale too easy at the younger ages and too difficult at the older ones, so that the average child of 5 would test above the mental age of 5, while the average child of 12 would test below the mental age of 12. Sometimes a child's IQ would show a sudden decrease at adolescence as an artifact of the test items themselves. In revising the scale, Terman constantly added and deleted test items until it yielded an average IQ of 100 for unselected groups of children at any age. Ninety tests were included in the final 1916 Stanford revision of the Binet-Simon scale. This revision quickly became the standard measure of children's intelligence. Terman considered its strengths to be:

1. The large standardization sample of 10,000 individuals living in the Stanford area. While the sample size was indeed impressive, it was also very homogeneous.
2. The use of IQ to represent a child's performance.
3. The extended age range of the test, from 5 to 16 years.
4. The clear, detailed, and well-organized instructions for administering the test. Such clear instructions increased the reliability of the test when different people gave it at different times.

Given these strengths, the question of the validity of Terman's revision remains. How well did the scale measure what it was supposed to measure? How accurate a measure of a child's intelligence did it provide? Terman's core beliefs were that intelligence was greatly influenced by heredity and was constant. He went to great lengths to assess the validity of the scale. He compared teachers' gradings of the schoolwork of 504 children with the children's IQ scores. He found fairly close agreement, but in one case out of ten there was disagreement. He also found a correlation of 0.48 between teacher estimates of intelligence and IQ scores and a good correlation between grades and IQ scores. It is somewhat anomalous that much of the impetus for the development of intelligence tests came from dissatisfaction with teacher ratings and evaluations of intelligence, which Terman was now using to assess the validity of the tests themselves. However, Terman's difficulty is easily understood, since the selection of appropriate validity criteria for intelligence tests remains a problem today.

In the United States, the 1916 Stanford-Binet scale remained the standard test instrument for measuring intelligence until 1937, when Terman and his coworkers published their second revision. For this revision they used a standardization sample of three thousand people that was both large and varied, as it included people from all areas of the United States. The range of the 1937 scale was from age 2 through adolescence to four levels of adult intelligence. Two comparable forms of the 1937 revision were available, allowing a person to be tested twice. This second Stanford revision also enjoyed widespread acceptance and popularity.

Terman's Studies of Genius

In developing his Binet-Simon revisions, Terman tested a number of children with very high IQs—by 1921, he had studied 120 high-IQ children. In addition to finding they were of high intelligence, Terman believed these children were exceptionally well-adjusted and superior in all aspects of character and behavior. In 1921 he began a much more intensive study of such children. In his 1905 Ph.D. dissertation, Terman had argued that psychology must connect itself with life. In his studies of these children of genius, Terman connected psychology with their lives, and this connection yielded some of the most important data ever collected by psychologists. Terman's genetic studies of genius are true classics in psychology (Cravens, 1992).

This ambitious longitudinal investigation began in 1921, supported by a grant of $34,000 from the Commonwealth Fund of New York and a smaller amount from Stanford University. Terman was in his mid-40s, and the average age of the children selected was 11 years old. Terman directed the investigation until his death in 1956, when his coworkers continued it. To date, data have been collected for more than eight decades. Not only did Terman collect data and direct the study, he also supported it financially and maintained close and affectionate contact with the participants. Terman thought of the children as "his children" long after they reached adulthood, always beginning his letters to them with the salutation "To my gifted children." To him they were special. The "children" returned his warmth and friendship to such a degree that in 1958, nearly forty years after the study began, 95 percent of the surviving members of the original group were still participating. Some years ago, I saw the warmth and affection one of Terman's "children" felt for him. Curious about the gold termite lapel pin the wife of one of my colleagues often wore, I asked her about it. She told me she had been one of Professor Terman's children, the "Termanites or Termites," and so was proud to wear her termite pin. The men wore Termite tie clasps.

Terman's aim was to conduct a long-duration investigation of the physical, mental, and personality traits of a large group of gifted children. What sort of adults did children of genius become? His gifted children were selected from urban schools in California, mainly in Los Angeles, San Fransisco, Oakland, Berkeley, and Alameda. Each teacher in grades three to eight was asked to nominate the three brightest students and also the youngest student in his or her class. Those children were then given the Stanford-Binet intelligence test in their schools by Terman's six assistants, and those with IQs over 140 were selected to participate in the study. In all, 1,528 children (857 boys and 671 girls) were chosen. The main experimental group consisted of 661 of these children (354 boys and 307 girls). These were the children who were to be intensively studied throughout their lives and from whom Terman and his associates drew their generalizations about gifted children. Two other subgroups of unselected elementary- and high-school-age children were to serve as control or comparison groups. The average chronological age of the 661 children in the main study group was 11 years, with a range from 8 to 12 years old, and a small number of younger children and teenagers included. Their mean IQ was 151, and the range of their IQ scores was from 135 to 200, with seventy-seven children scoring above 170. They also scored highly on the National Intelligence Test and on a variety of special tests Terman had devised. Terman collected detailed information about family background, educational history, physique, health, interests, preoccupations, character, and personality, allowing the first comprehensive portrait of the gifted child. This mass of information was summarized in 1926 in the first volume of a series of *Genetic Studies of Genius.* The children were described as typically the products of parents with superior educational and cultural backgrounds; they were accelerated some 14 percent in grade placement; typically they had learned to read early, read widely and well, and enjoyed a wide range of childhood activities. They were taller and broader-shouldered and had greater lung capacity than the average child. Clearly the popular stereotype of the gifted child as a sickly weakling, a "brain" interested in nothing but books, did not apply to these children.

Terman did his first follow-up study in 1927 and 1928, when the average age of the children was 17 to 18 years and the majority of them were in high school. They were given a battery of psychological tests, and detailed biographies of their adolescent years were collected. This information was published in 1930 in volume 3 of the series *The Promise of Youth* (Barks, Jensen, & Terman, 1930).[7] The children's test scores had changed little, placing them among the top 1 percent of the general population; their schoolwork had been consistently excellent—two-thirds of the girls' high school grades and half the boys' grades were A's. They continued to have varied interests and activities and to excel in nearly all of them.

A second follow-up was done in 1939 to 1940, when the average age of the subjects was 29 to 30 years. They were tested, and information was collected about their early adulthood (Terman & Oden, 1947). Their test scores again placed them above the 99th percentile of the adult population. Their educational record was outstanding: 87 percent of the men and 83 percent of the

[7] Volume 2 of the series was a retrospective investigation and reconstruction of the IQs of 294 men and 7 women of genius who had lived in earlier times. This curious study grew from the dissertation research of Terman's student, Catherine Morris Cox. In the Galtonian tradition, Cox assessed the publications, awards, recognitions, and contributions of these eminent men and women and assigned them IQ scores. Terman (1917) estimated Galton's IQ to have been more than 200, even higher than Cox's estimate for John Stuart Mill (190), and substantially higher than Mozart (150), Jefferson, Franklin, Darwin, and Galileo (145), Beethoven (135), Newton (130), Washington, Lincoln, and Bach (125). Such assignments are at best curiosities.

women had entered college, and 70 percent and 67 percent, respectively, had graduated. At the time, only 7 percent of the general population were college graduates (Caplow, Hicks, & Wattenberg, 2001, p. 53). As undergraduates, 40 percent of the men and 35 percent of the women won high academic honors; 56 percent of the men and 33 percent of the women continued their educations and took one or more advanced degrees. Contrary to a common "early ripe, early rot" stereotype, they had not peaked too early and petered out.

The last follow-up Terman was directly involved in was done between 1950 and 1952 (Terman & Oden, 1959). Contrary to the popular belief in "burnout" among gifted people in their middle years, the group continued to excel. Eighty-seven percent of the men were in the professions: lawyers, physicians, engineers, faculty members, or businessmen. Thirty percent of the group had incomes greater than $15,000, placing them in the upper 1 percent of American incomes in 1954. Remarkably for the time, 42 percent of the women held full-time positions. By their mid-40s, the group had produced thousands of scientific papers, 60 nonfiction books, 33 novels, 375 short stories, 230 patents, and numerous radio and television shows, works of art, and musical compositions. Behind these percentages stood real people whose career biographies are impressive not only for their distinction but also for their variety. Terman's gifted group included a well-known columnist, a number of authors, an Oscar-winning motion picture director, a Walt Disney staff artist, jazz musicians, radio announcers, a linguist who mastered fifteen languages, a fox farmer, a dealer of rare stamps, a millionaire real estate developer, successful inventors, a number of judges, and the police chief of a major city. As mature adults, they had maintained a breadth and range of interests.

After Terman's death in 1956, his coworkers continued to study the gifted group. Robert Sears (1908–1989) convened a national planning committee to take advantage of what was correctly seen as a unique opportunity to investigate later maturity. M. H. Oden published volume 5 of the *Genetic Studies of Genius* series and conducted a follow-up in the 1960s, when the men and women were approximately 50 years old (Oden, 1968). In 1972 the gifted men were studied by Robert Sears and Lee Cronbach (Sears, 1977). Four hundred eighty-six men, or 75 percent of the living members of the original group, participated in this follow-up. In 1981, forty-five men, then septuagenarians, all of whom had been in the Terman study, were interviewed at UCLA. They were seen biannually from that time on (Shneidman, 1989). Most of these men were enjoying the Indian Summer of life:

> For bright people, especially for bright people who have continued to be intellectually active all their adult lives, the decade of the 70s can be a rather "quiet" period of no great significant decline in either intellect or working vocabulary. There is evident physical slowing-down, but cerebral senility is not evident. The 70s are not as "old" when one is in them as they appeared to be when one was young. Perhaps this finding is especially true for people who continue to work, more especially for those who continue, as the phrase goes, to use their brains. (Shneidman, 1989, p. 692)

A similar study of the gifted women was done by Pauline Sears and Ann Barbee (Sears & Barbee, 1977). Their study placed emphasis on sources of life satisfaction. Two-thirds of the group had married, and their divorce rate was below the national rate; their mortality and suicide rates were also below the average, and they had fewer confinements in mental hospitals. They generally reported that they were content and satisfied with their lives, countering the stereotype of the "tortured woman genius" who can never be happy or content. It is also evident, however, that opportunities for many of these women were very constrained.

Terman's gifted men and women have now been studied for over eighty years (Holahan & Sears, 1995). That is a remarkable achievement and a tribute to the creativity and perseverance of Terman and his associates. Inevitably a study of this magnitude has had its critics: First, the sample has been described as unrepresentative, which indeed it was. There were very few Mexican-American, black, or Asian subjects, while Jewish children were overrepresented. Most of the children came from professional, urban families (Vialle, 1994). Second, Terman's group grew up during unusual times, through the Great Depression and World War II. Third, simply having been chosen to participate in the study and being continuously reminded of their brilliant status might have changed the way these children behaved. In addition, Terman became actively involved in their lives, writing letters of recommendation, providing scholarships (often anonymously), and opening academic doors for his "Termites" (Shurkin, 1992). Fourth, Terman's comparisons with the children in the control group were limited. Fifth, Terman reported the data throughout the study in terms of group norms or averages rather than tracking the children as individuals. So the study was longitudinal in that it followed a group of individuals through life, but it did not focus on the individuals themselves (Cravens, 1992, p. 187). Fifth, even the subjects' achievements have been questioned. *Time* magazine echoed such questions in Terman's obituary:

> His [Terman's] bright children grew up healthier, slightly wealthier, and better employed than the average child, but the group contained no mathematicians of truly first rank, no university president . . . gives no promises of contributing any Aristotles, Newtons, Tolstoys. (*Time,* December 31, 1956, in Gerow, 1988, p. 45)

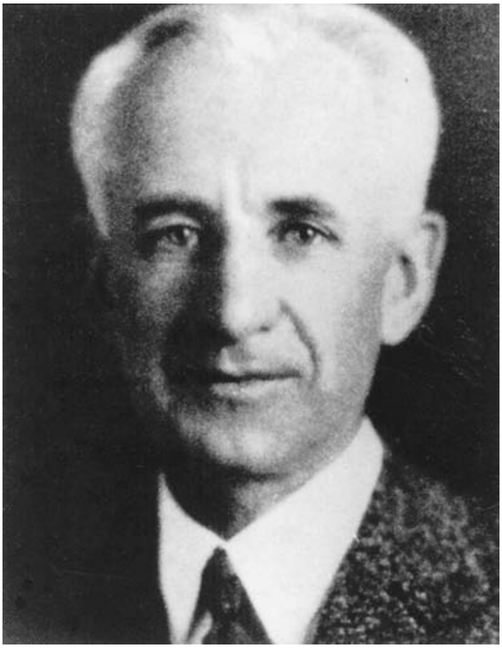
Finally, some have said Terman constructed a "countermyth" of the super-achieving person of genius. Despite these criticisms, Terman's study was an outstanding contribution and is an example of psychological research at its best.

The last important development in the history of intelligence testing occurred with the 1917 mobilization of armed forces for America's entrance into World War I. The pivotal role in organizing the contribution of psychology belonged to Robert Mearns Yerkes.

ROBERT MEARNS YERKES (1876–1956)

Yerkes's Early Life

Robert Mearns Yerkes was born on a farm near Philadelphia in 1876. As children, both Yerkes and a younger sister contracted scarlet fever. His sister died,



Robert M. Yerkes (1876–1956), the pioneer comparative psychologist who directed the Army Testing Program.
(Archives of the History of American Psychology)

and Yerkes was left physically weak. Despite this, he was able to follow the classic American path of working his way through college. He attended Ursinus College while earning his board and a salary of $10 a month as a live-in handyman for his uncle, a physician. Yerkes graduated in 1897 and entered Harvard University, where Hugo Münsterberg (Chapter 5) encouraged him to pursue his interest in comparative psychology. Yerkes received a Ph.D. degree in 1902. As a graduate student, he had an outstanding record and so was offered an appointment as an instructor in comparative psychology at Harvard. At first, both he and Münsterberg wondered if he could afford to accept the position; the salary was only $1,000 per year, but he accepted it and he never regretted his decision. Yerkes remained at Harvard until 1917, and his years there were among the most fruitful and happy of his life (Yerkes, 1932/1961).

Yerkes's Comparative Research and Early Psychometric Investigations

At Harvard, Yerkes found himself in distinguished company. The university's three great philosopher-psychologists—William James (Chapter 9), Josiah Royce, and George Palmer—were still active members of the faculty. Yerkes, however, was far from being intimidated. Sidney Pressey, a Harvard student at the time, recalled that when Yerkes joined the faculty, he moved into an attic office in Emerson Hall that had on the wall a formal portrait of James, Royce, and Palmer. Yerkes took the portrait down and replaced it with photographs of three great apes, saying, "These are my philosophers" (Pressey, 1974). True to his boast, Yerkes began his studies of the mental life of monkeys and apes in collaboration with Ada Watterson, who later became his wife. These studies culminated in 1929 with their classic publication, *The Great Apes.* At Harvard, Yerkes also studied the physiology of the invertebrate nervous system, habit formation in vertebrates and invertebrates, problems of instinct versus individual acquisition of habits, observations of the behavior of dancing mice and the inheritance of their characteristic gaits and postures, and studies of savageness in wild rats. His coworkers included Edward Thorndike (Chapter 10). These were pioneer investigations in comparative psychology.

Yerkes also took advantage of an opportunity Ernest E. Southard, professor of neuropathology in the Harvard Medical School, provided, allowing him to work as a psychologist at the Boston State Psychopathic Hospital. There Yerkes became aware of the need for improved methods of psychological examination and measurement. With the assistance of James Bridges and Rose Hardwick, he developed a point scale for measuring intellectual ability, arranging the test items in order of difficulty so that the testee's score depends on the number of items passed (Yerkes, Bridges, & Hardwick, 1915). Yerkes also developed a multiple-choice test of idea formation. This experience in test construction and use was of great value to Yerkes when he directed a major part of psychology's response to World War I.

The Army Alpha and Beta Tests

On April 6, 1917, the day President Woodrow Wilson signed a declaration of war and the United States entered World War I, the Society of Experimental Psychologists was meeting at Harvard (Chapter 5). Yerkes arranged a special session to discuss the contributions psychologists might make to the war effort. Titchener, the chairman of the meeting, excused himself from the planning session, so Yerkes took the chair. Titchener's explicit reason was that as a British subject it was inappropriate for him to attend, but it also seems likely, as John O'Donnell (1979) speculated, that he might have feared that Yerkes and his colleagues were about to stray from "pure experimental psychology" and "trade a science for a technology" (Titchener, 1914a, p. 14). At this planning session, the participants agreed that Yerkes, the current president of the APA, should visit Canada to study the psychological problems the Canadians had experienced during their years at war since 1914 and the ways in which psychologists might best contribute to the war effort. An early meeting of APA would be requested to discuss the psychologists' response to the national emergency.

Yerkes responded with alacrity, traveling to Canada on April 10. There he met Carl C. Brigham, a psychologist attached to the Canadian Military Hospitals Commission. With Brigham as his guide, Yerkes visited Montreal, Ottawa, and Toronto, meeting the Canadian authorities and hearing their recommendations as to how psychological methods could best be used to select and grade recruits. The APA's council met in Philadelphia on April 21 and 22 and appointed a committee of nine psychologists, including James McKeen Cattell, G. Stanley Hall, Edward Lee Thorndike, J. B. Watson, and Yerkes, to study the role of psychology in the war effort.

They decided to concentrate on developing methods of psychological examination specially adapted to military needs. They faced opposition from psychiatrists unwilling to concede such examinations to psychologists. As a compromise, the psychologists agreed to restrict their examinations to intelligence. At Goddard's invitation, a group of psychologists, including Terman and Yerkes, spent two weeks at the beginning of June at the Vineland Training Institute preparing psychological tests and examinations. Starting in July they tried these tests out in a number of institutions and then on selected Army and Navy bases. On August 9, Yerkes was recommended for appointment as a major to organize psychological examinations for the Army. At his recommendation, a group of forty psychologists assembled and began to prepare tests for widespread use by the Army. On October 1, psychological examinations began in four Army camps. In a letter to the Surgeon General of the United States Army written on November 16, Yerkes outlined the aims of these examinations: to aid in segregating the mentally incompetent, to classify men according to their mental ability, and to assist in selecting the most competent men for special training and positions of responsibility (Yerkes, 1921, p. 19).

On December 24, the Surgeon General ordered that psychological examination be extended to the entire Army and that all newly drafted and enlisted men be tested. Yerkes organized a psychological service of 115 commissioned officers and 300 enlisted personnel. They used the following criteria in devising and selecting tests:

1. The test had to be a group test. The wartime draft was about to transform the 200,000 professional soldiers of the prewar Army into a force of 3.5 million men. Very large numbers were being inducted every day, and so individual tests were not possible.
2. The test was to measure "native wit" and to be as independent as possible of schooling.
3. The test was to be steeply graded in difficulty, hard enough to tax men of high intelligence but easy enough for those of lesser ability to take it.
4. The test could not take more than an hour to administer and had to be simple to score objectively.

In 1917, only 9 percent of enlisted men had graduated from high school. In the preliminary testing, they found that some 40 percent of the inductees were not sufficiently literate to be able to read and follow written instructions, so two forms of the test were constructed: the Army Alpha Test for men who were literate and the Army Beta Test for those who were illiterate or were not English-speaking. Both tests were administered to groups of inductees with military precision. The Army Alpha Test had eight individual tests:

Following directions	Arithmetic problems
Practical judgment	Synonyms-antonyms
Disarranged sentences	Number series completion
Analogies	General information

The Army Beta Test had seven individual tests:

Maze drawing	Cube analysis
X-O series completion	Digit-symbol substitution
Number checking	Picture completion
Geometric constructions	

During 1918 the testing program expanded rapidly, and by autumn, testing units were in place at thirty-five Army camps throughout the country. Fifty psychologists tested 200,000 men a month. On November 11, 1918, the armistice was signed, ending the war. The psychological testing program ended officially on January 31, 1919, by which date 1,726,966 men had been tested. Under the most difficult and demanding conditions, Yerkes had led psychologists to mobilize. Judged in terms of the number of men tested, the program had been a success, and Yerkes's administrative and organizational abilities were clearly of the highest order. Psychologists have often described the Army Testing Project as an example of how psychology can respond to a national emergency in a practical and useful way. Without doubt, the Army Testing Project advanced the careers of many psychologists. In 1917, Yerkes was appointed chairman of an important division of the National Research Council (NRC), and James Rowland Angell was elected chairman of the Council. The NRC supported the construction of the *National Intelligence Test for Children.* Within thirty months of its publication, more than 4 million children were tested; during the 1920s, it was given to 7 million American schoolchildren.

The war, and specifically the Army Testing Project, also had a great impact on psychology. All but one of the sessions at the December 1918 meeting of the APA dealt with war problems. Hall commented:

> The war had given psychology a tremendous impulse. This will, on the whole, do good; for psychology, which is the largest and last of the sciences, must not try to be too pure. . . . In a peculiar sense, the future of the world depends upon American psychology. (Hall, 1919, pp. 48–49)

Other psychologists were equally optimistic. Cattell declared in 1922 that the war years had put psychology "on the map," and in his presidential address to the APA, Terman said:

> It is the method of tests that has brought psychology down from the clouds and made it useful to men; that has transformed the "science of trivialities" into the "science of human engineering." (Terman, 1924, p. 106)

It was not only psychologists who were impressed. According to the historian Harvey Wish, "Psychology emerged triumphantly [from the war] with practical tests of all kinds" (Wish, in Dennis, 1984, p. 23). A writer in *Harper's* remarked:

> In practically every walk of life, this bright little device [mental test] is being introduced as a means of finding out what people don't know, and for what particular business they are specially fitted. (In Dennis, 1984, pp. 23–24)

The *New York Times* described mental tests as becoming a popular and all-pervading pastime. Psychologists were not the only ones to devise and use such tests. One of the most publicized and controversial was the questionnaire the American inventor and scientist Thomas Edison developed (Dennis, 1984). Edison's questionnaire had forty-eight general information questions, including:

What countries border France?

What telescope is the largest in the world?

Who was Plutarch?

Where does most of the world's coffee come from?

How is leather made?

Why is cast iron called pig iron?

Edison arranged for several hundred job applicants for his plants to take his questionnaire. In May 1921, Edison announced in the *New York Times* that the performance of recent college graduates on his test was extremely disappointing; they were amazingly ignorant and did not seem to know anything. Given Edison's status as America's great genius, his conclusion carried weight. Sensational newspaper articles followed with both positive and negative reactions. The publicity attracted attention to mental tests but also undermined their scientific status and the credibility of the conclusions psychologists and others derived from tests.

One final question regarding the Army Testing Program is: What did psychology and psychologists actually do for the war effort? Franz Samelson examined the evidence and concluded that it is at best "rather equivocal" (Samelson, 1977, p. 274). Psychologists in the Army Testing Project recommended that some 7,800 men (0.005 percent) be discharged as mentally unfit to serve in the armed forces. This percentage is minute, and Samelson further pointed out that the psychologists' recommendations were often ignored. The Army had a war to fight, and the recommendations of a group of psychologists were of little consequence to the generals. For the military officials, the link between low test scores and poor soldiering was not established. The Army report includes some favorable letters from commanding generals of the camps where the tests were administered. However, these favorable evaluations are not convincing, for had the test program been a clear success, the Army would have continued it after the war. Such was not the case. Soon after the armistice, Army intelligence testing stopped.[8] Perhaps the most conservative conclusion is to agree with Yerkes that while the Army Test Project could have increased the Army's efficiency and could have saved millions of dollars, it could have done so only if the information had been used. In the great majority of cases, it was not (Yerkes, 1932).

Reaction to the Army Report

The results of the testing project were presented in Part 3 of the final report on the Army Testing Project in more than three hundred pages of tightly packed

[8] When America entered World War II, psychologists again mobilized to develop appropriate classification procedures. The result was the Army General Classification Test (Harrell, 1992).

data and analysis. Unfortunately, these pages were read by few but quoted by many. A man's score on the tests was obtained by adding subtest scores. Through a statistical procedure, this combined score was then transformed into a mental age. While nearly all the results were reported as point scores, the authors chose to use mental age equivalents in answering the question "How intelligent are men in the Army?" They concluded:

> It appears that the intelligence of the principal sample of the white draft, when transmuted from alpha and beta examinations into terms of mental age, is about 13 years (13.08). (Yerkes, 1921, p. 785)

The researchers claimed 13 years to be a reasonable estimate of the mental age of the white population as a whole. Since the adult mental age had previously been assumed to be 16 years, this finding was disturbing. The report's conclusions as to the percentage of mentally defective people in the general population exacerbated the distress. The Army report used Goddard's term *moron* to describe adults with a mental age below 13 who were sufficiently retarded to be unable to pass beyond the sixth grade. It concluded:

> If this definition [of morons] is interpreted as meaning anyone with a mental age of less than 13 years, as has recently been done, then almost half of the white draft (47.3 percent) would have been morons. Thus it appears that feeble-mindedness, as at present defined, is of much greater frequency of occurrence than had previously been supposed. (Yerkes, 1921, p. 789)

These conclusions were buried in a 900-page, half-million-word report, but they were so sensational that newspaper and magazine articles and books quickly made them known. One wonders how veterans must have reacted. They had been inducted into the Army, and had fought and helped win a terrible war, and now psychologists were reporting that half of them were moronic.

Racist, antidemocratic conclusions were often part of the popularized accounts. Some authors advocated an intellectual quasi-caste system in which a person's station in life would be determined by his or her score on an intelligence test. Goddard in *Human Efficiency and Levels of Intelligence* (1920) stated that the average mental age of the white population of the United States was 13 years and that of the Negro population was "much lower." He concluded that 45 million whites had mental ages below 13 and, given such numbers, questioned the viability of a successful democracy in the United States. While Goddard was confident that people of lower intelligence would usually allow themselves to be ruled by people of higher intelligence, he raised the specter of a Russian-style revolution should the "unintelligent millions decide to take matters into their own hands" (Goddard, 1920, p. 97). As a solution to this problem, Goddard proposed that these people be disenfranchised and that America's democracy be replaced with a meritocracy based on tested intelligence levels.

Goddard believed equality to be a myth, a psychological impossibility. Millions of dollars, he said, had been wasted in futile attempts to improve the lot of the poor and disadvantaged. His belief is difficult to understand; the Army tests had found correlations as high as .81 between test scores and years of schooling. Society, Goddard urged, must accept different levels of intelligence as a fundamental fact. Intelligence levels for different occupations must be determined, and only people at those levels should be allowed to perform those jobs. He also recommended that such provisions be applied retroactively; that is, once an intelligence level had been established for a particular occupation or profession, all members of that group should be tested, and only those men and women whose test scores were above the set level should be allowed to continue their careers. Goddard reassured his readers that this would work no hardship and might actually increase personal happiness, for there is nothing so uncomfortable, he said, as to be in a profession or career in which one is not intellectually suited.

Goddard's Draconian proposals were well-received. In a review in the *Journal of Biology,* Paul Popenoe praised Goddard's books as a "real service to biology" (Popenoe, 1921, p. 233) and endorsed his proposals. Eugenicists and such groups as the Race Betterment Foundation of Battle Creek, Michigan, enthusiastically publicized and supported Goddard's recommendations. In a sensational article, Albert Wiggam declared that the Army report demonstrated that any belief in human equality is a "great sentimentality" (Wiggam, 1922, p. 645). He concluded that "slum-people make the slums" (Wiggam, 1922, p. 646) and that efforts to improve living standards and educational opportunities for the disadvantaged are folly, since they allow the weak elements in a nation's genetic pool to survive. In 1923, Carl Brigham, the Canadian psychologist who had assisted Yerkes in the early days of the Army Testing Project, published *A Study of American Intelligence.* The book had a curious history. Charles W. Gould, a eugenicist and advocate of the superiority of "pure" races, had urged Brigham to write the book and had supported the project financially. As Brigham admitted in the foreword, Gould "read and reread the manuscript at all stages of preparation and was mainly responsible for the whole work" (Brigham, 1923, p. vii). Brigham reanalyzed the Army data, paying special attention to the intelligence of immigrants to the United States. He drew these major conclusions:

1. The Army mental tests did, indeed, measure innate intelligence.
2. The average scores of native-born draftees were higher than those of foreign-born draftees.
3. The average intelligence of immigrants was declining, as shown in the following table.

Period	Number of Cases	Combined Scale Average (mental age in years)
1887–1898	764	13.82
1899–1902	771	13.55
1903–1907	1,897	12.47
1908–1912	4,287	11.74
1913–1917	3,576	11.41

(Adapted from Brigham, 1923, p. 177)

This steady decline was attributed to the increasing proportion of immigrants from central European and Mediterranean countries. Brigham claimed that the mental ages of these immigrants were consistently lower than those of Nordic immigrants from Western Europe.

Brigham accepted the doctrine of Nordic superiority originally proposed by Madison Grant in *The Passing of the Great Race* (1916). Grant was chairman of the New York Zoological Society and a trustee of the American Museum of Natural History. His book was a best-seller going through eight reprintings in four editions over seven years. Grant wrote:

> The Nordics all over the world, a race of soldiers, sailors, adventurers, and explorers, but above all of rulers, organizers, and aristocrats are in sharp contrast to the essentially peasant and democratic character of the Alpines. The Nordic race is domineering, self-reliant, and jealous of their personal freedoms both in political and religious systems, and as a result they are usually Protestants. (Grant, 1916, p. 228)

Brigham's conclusion was that an uncontrolled influx of non-Nordic immigrants from Southern and Eastern Europe would lower native American intelligence, and so he recommended that only those of Nordic stock be allowed to immigrate. Terman, in a 1923 address to the National Education Association, claimed that differential birth rates of "good," that is, northern European, and "bad," that is, Mediterranean, Mexican, and African racial stocks were such that after 200 years, an original group of 1,000 Harvard graduates (presumably "Nordic") would have 50 descendants, while an original group of 1,000 southern Italians would have 100,000 descendants (Terman, 1924, p. 113).

Such racist, antidemocratic views had credibility, since their authors were respected members of the scientific community. Brigham was a member of the Psychology Department at Princeton University. His book was introduced by Yerkes, who wrote:

> Mr. Brigham has rendered a notable service to psychology, sociology, and above all to lawmakers by carefully reexamining and re-presenting with illuminating discussion the data relative to intelligence and nativity first published in the official report of psychological examining in the United States Army. It behooves us to consider their reliability and their meaning, for no one of us as a citizen can afford to ignore the menace of race deterioration or the evident relation of immigration to national progress and welfare. (Yerkes, foreword to Brigham, 1923, p. vii)

The National Origins Act of 1924 established immigration quotas based on the proportion of each nationality recorded in the 1890 census, that is, before the wave of central and southern European immigrants arrived. Congressmen expressed the hope that such restrictions would restore the "genetic integrity" of the United States. However, while the views of Goddard, Brigham, and Yerkes were influential, they did not go unchallenged.

The Challenge

In the 1920s, the psychological community was divided in its evaluation of the Army Testing Project and its reaction to the recommendations of Goddard, Terman, and Brigham (Synderman & Herrnstein, 1983). In 1922, Horace B. English, a psychologist who had also participated in the Army Testing Project, asked the question "Is America feeble-minded?" He answered that America was not and stated that conclusions to that effect had been based on a misreading of the Army data. E. G. Boring (1923) stressed the need for more adequate and better data before legislative recommendations such as Brigham's were made. F. N. Freeman in 1923 surveyed a number of leading mental testers, including Yerkes and Terman, and published their consensus that there was no logical way to judge the relative native mental abilities of groups that had dissimilar upbringings.

Earlier Freeman had admonished his colleagues for their descriptions of the average mental age of the population as a whole (Freeman, 1922). Such averages, he said, were indefensible. He stressed that it was time to stop talking nonsense about such matters (Freeman, 1923). However, the most vigorous attack came not from a psychologist, but from a well-known columnist and commentator, Walter Lippmann, a man described by his biographer as "without doubt the nation's greatest journalist" (Steel, 1980, p. xvi).

In a series of articles in 1922 and 1923 in the *New Republic,* a magazine he had founded and edited, Lippmann lambasted Yerkes, Terman, and Brigham, their assumptions, and their conclusions. He was especially critical of the assumption that intelligence tests measure native intelligence and of claims that the average mental age of the white population was 13 years. Lippmann stressed the importance of differences in early environment and experiences; he felt that these differences were so great that they made comparisons of different classes and races meaningless. Lippmann argued that it was logically impossible for the intelligence of the average adult to equal that of an immature child:

> It is quite impossible for honest statistics to show that the average adult intelligence of a representative sample of the nation is that of an immature child in that same nation. The average adult intelligence can not be less than the average adult intelligence. (Lippmann, 1922a, p. 213)

Lippmann cited an earlier estimate of 16 years based on the results of a group of people tested with the Stanford-Binet test. Thus the average intelligence could be either 16 or 13, depending on which test was used. Obviously it could not be both, and Lippmann argued that all such claims were nonsense.

While he saw some potential usefulness for testing in school administration and acknowledged the importance of Binet's tests, Lippmann castigated the work of later psychologists. "It leads one to suspect," he wrote, "after such a beginning, that the real promise and value of the investigation which Binet started is in danger of gross perversion by muddleheaded and prejudiced men" (Lippmann, 1922a, p. 215). Lippmann wrote movingly and with foresight in describing the dangers of premature classification of children in terms of intelligence:

> If, for example, the impression takes root that these tests really measure intelligence, that they constitute a sort of last judgment on the child's capacity, that they reveal scientifically his predestined ability, then it would be a thousand times better if all the intelligence testers and all their questionnaires were sunk

> without warning in the Sargasso Sea. One only has to read the amount of literature on the subject, but more especially in the work of popularizers to see how easily the intelligence test can be turned into an engine of cruelty, how easily in the hands of blundering or prejudiced men it would turn into a method of stamping a permanent sense of inferiority upon the soul of a child. (Lippmann, 1922c, p. 297)

To Lippmann, labeling children with IQs or mental ages was contemptible. He ended his series of articles with this indictment of both tests and testers:

> The claim that we have learned how to measure hereditary intelligence has no scientific foundation. We cannot measure intelligence when we have never defined it, and we cannot speak of its hereditary basis after it has been indistinguishably fused with a thousand educational and environmental influences from the time of conception to school age. The claim that Mr. Terman or anyone else is measuring hereditary intelligence has no more scientific foundation than a hundred other fads, vitamins, and glands, and amateur psychoanalysis and correspondence courses in will power, and it will pass with them into that limbo where phrenology and palmistry and characterology and the other Babu sciences are to be found. (Lippmann, 1922d, p. 10)

Four weeks later, Terman replied to Lippmann's charges in an article published in the *New Republic* (Terman, 1922). His reply is uncharacteristically harsh and drips with venom and sarcasm. It is clear that he considered Lippmann an uninformed layperson who had no right to question the scientific basis and findings of testing. The title of his reply—"The Great Conspiracy: The Impulse Imperious of Intelligence Testers, Psychoanalyzed and Exposed by Mr. Lippmann"—reveals its tone. Terman claimed that the validity of psychological tests was beyond question and that it would be pointless to debate the matter. Lippmann, he said, was confused over the issue of the average mental age of the general population, although Terman did admit that there was some disagreement among psychologists as to how to interpret this finding. He parodied Lippmann's belief in the importance of environment during the first four years of life in the following savage passage:

> One wonders why Mr. Lippmann, holding this belief, did not suggest that we let up on higher education and pour our millions into kindergartens and nurseries. For, really and truly, high IQs are not to be sneered at. . . . And just to think that we have been allowing all sorts of mysterious uncontrolled, chance influences in the nursery to mold children's IQs this way and that way, right before our eyes. It is high time that we were investigating the IQ effects of different kinds of baby talk, different versions of Mother Goose, and different makes of pacifiers and safety pins. If there is any possibility of identifying, weighing, and bringing under control these IQ stimulants and depressors, we can well afford to throw up every other kind of scientific research, until the job is accomplished. That problem once solved, the rest of the mysteries of the universe would fall easy prey before our made-to-order IQs of 180 or 200. (Terman, 1922, p. 119)

Terman went on to suggest endowment of the "Walter Lippmann Bureau of Nursery Research for the Enhancement of the IQ" (Terman, 1922, p. 119). He was an unwitting prophet. In recent decades, psychologists have often studied the effects of various early enrichment experiences on intellectual performance.

Think of the Head Start program, for example. Given the choice Terman proposed between supporting colleges and supporting nursery schools, Rhoda Kellogg, a distinguished contemporary developmental psychologist, responded that she would recommend supporting nurseries (Kellogg, 1972).

Terman's sarcastic, hostile response with its frequent personal remarks—"It is evident that Mr. Lippmann has been seeing red; and also that seeing red is not very conducive to seeing clearly" (Terman, 1922, p. 119)—allowed Lippmann to respond in kind: "Mr. Terman's logical abilities are so primitive that he finds this point impossible to grasp" (Lippmann, 1923, p. 146), and to aver that "a psychologist who sneers at the significance of early impressions and habits is too shallow to write about education" (Lippmann, 1923, p. 146). Terman had accused Lippmann of having an "emotional complex" about testing, a complex Lippmann freely acknowledged, for, as he said:

> I hate the impudence of a claim that in fifty minutes you can judge and classify a human being's predestined fitness in life. I hate the pretentiousness of that claim. I hate the abuse of scientific method which it involves. I hate the sense of superiority which it creates, and the sense of inferiority which it imposes. (Lippmann, 1923, p. 146)

Lippmann was a master of such exchanges, and the Terman who responded to his charges does not seem the same person whose enlightened work and writings were presented earlier in this chapter. Lee Cronbach cited Terman as an example of a scholar involved in a public controversy who loses his "composure, clarity and judgment" (Cronbach, 1975, p. 12).

The Lippmann-Terman debate ended, and the controversy faded. Research by psychologists continued, and in at least one notable case it produced a change of mind. In 1930, Brigham published a paper discussing intelligence testing of different immigrant groups. He concluded that such testing was invalid and that the results were of no value. The last paragraph of his paper is a remarkably open and honest admission of the error of his earlier views:

> This review has summarized some of the more recent test findings which show comparative studies of various national and racial groups may not be made with existing tests, and which show, in particular, that one of the most pretentious of those comparative racial studies—the writer's own—was without foundation. (Brigham, 1930, p. 165)

LATER CONTROVERSIES

The decade of the 1920s was a period of great controversy surrounding mental tests. It is remarkable that just twenty years after Binet and Simon published the first individual test for children, nearly 2 million men had been tested in the United States Army and 7 million children had been tested in schools. Mental testing was an idea whose time had come, and the tests were widely used—perhaps used too widely too soon. Much as psychologists might have wanted the test results to be neutral, they were not. Had more time been available for the development and validation of these tests, psychologists might have been in a better position to respond to their critics. But history does not

The Cyril Burt Affair

At midcentury, Cyril L. Burt (1883–1971) was the most prominent British psychologist. Burt was strongly influenced by Galton and Pearson's hereditarian conceptions of intelligence (Chapter 9). Burt held the chair of psychology at University College of the University of London, arguably the most prestigious position in British psychology. He was knighted Sir Cyril in 1946, and in 1971 he received the American Psychological Association's Thorndike Award for distinguished service to educational psychology.

In 1976, five years after his death, sensational newspaper headlines in London proclaimed that at least some of Burt's work was fraudulent (Gillie, 1976). Charges and countercharges followed, with the media in hot pursuit; scientific fraud is always a compelling story. In 1979, an apparently definitive biography of Burt was published by Leslie S. Hearnshaw (1907–1991). Hearnshaw was the unofficial historian of British psychology, a psychologist familiar with Burt's work, and a friend of his family—in fact, Hearnshaw delivered the eulogy at Burt's funeral. Hearnshaw admitted to having reluctantly changed his mind in concluding that Burt had perpetrated a number of serious frauds. Of particular concern were Burt's results concerning identical twins.

THE IDENTICAL TWIN EVIDENCE

In the early 1950s, Burt and his coworkers published results from 21, then "more than 30," and then 42 pairs of identical twins reared apart (Chapter 9). Correlation coefficients for the IQs of identical twins reared apart were much closer than those for nonidentical twins reared together. Burt concluded that genetic factors dominated environmental factors in the determination of intelligence. In 1956, Burt reported additional data, giving a total of 53 pairs of identical twins reared apart. The IQ correlation for identical twins reared apart was +.771, a number identical to the third decimal place to correlations Burt had previously reported for the earlier twins. But that remarkable invariance apparently went unnoticed for over fifteen years! In 1972, Leon Kamin, a Princeton psychologist best known for his studies of animal learning, undertook a thorough review of Burt's publications. Kamin noticed the invariant correlation and pointed it out in lectures, colloquia, and then, in 1974, in his book *The Science and Politics of IQ*. To Kamin, such an invariant IQ correlation was highly unlikely and cast suspicion on the validity of Burt's data. Oliver Gillie, the medical correspondent of the *Sunday Times*, one of England's most respected papers, summarized Kamin's views and charged Burt posthumously with fraud and fabrication of data.

In his biography of Burt, Hearnshaw concluded that much of Burt's evidence had been fabricated; Hearnshaw had been unable to find case records or other data on the twins. The assistants who reportedly had tested the children and who had coauthored publications with Burt could not be found. Hearnshaw also concluded that Burt had fabricated a second major set of data on IQ, social mobility, and education. In both cases, the data were used to support Burt's strongly held hereditarian position. Reviews of Hearnshaw's book were generally favorable, including those by Hans Eysenck and Arthur Jensen (Chapter 9), who had formerly defended Burt and were advocates of the hereditarian view themselves. With this biography, Burt's reputation was left in ruins. The Burt affair began to appear in psychology textbooks as a cautionary example of scientific fraud. A

The Cyril Burt Affair (Continued)

1984 British Broadcasting Corporation program on Burt subtitled "A Story of Scientific Fraud" presented the case against Burt as proven.

THE BURT CASE REOPENED

Two books later reopened the Burt case. Robert B. Joynson in *The Burt Affair* (1989) described himself as a disinterested observer. He offered explanations other than fraud for most of the anomalies in Burt's data, including the invariant correlations. He accused Burt's detractors of character assassination, and was highly critical of Hearnshaw's biography. Joynson asserted that the invariant correlations coefficients were "something of a red herring" (p. 155). He could not accept that a sophisticated statistician such as Burt would have fabricated such consistent numbers. Their striking invariance was, for Joynson, compelling evidence that they were true. He also pointed out that in Burt's time, calculations of correlations were laborious, taking several hours, not the one-button push operation of today. He conceded that Burt's later correlations may not have been recalculated, but argued that this is not the same as fraud. He also attributed anomalies in the data to typographical and transcription errors. Again, Joynson concluded that Burt was careless, but not fraudulent. Some of Burt's data were destroyed during the bombing raids of the London blitz. The rest were burned shortly after his death on the advice of professionals who felt that they were in such disarray as to be useless. Ironically, the man who arranged for the destruction of Burt's files later collaborated with Oliver Gillie in his sensational exposé of Burt (Scarr, 1991, p. 200). Joynson cited a paper by Charlotte Banks, a former Burt student and colleague (Banks, 1983). Banks rejected Hearnshaw's allegations and reported that she had known the missing coworkers. Joynson also found evidence of the missing coworkers in a group photo, in membership records of the British Psychological Society, and in the recollections of others.

Ronald Fletcher, an author whose ideological bent can be seen in the title of his earlier book, *Instinct in Man* (Fletcher, 1966), also supported Burt. In *Science, Ideology, and the Media: The Cyril Burt Scandal* (1991), Fletcher examined media coverage of the Burt affair. He placed the media on trial, reviewing the evidence for the charges and countercharges as might have been done in a court of law. Fletcher's verdict was that the media coverage was atrociously biased and one-sided and that it accorded with the biases of the reporters and editors. In particular, Fletcher argued that their support of environmental views of the nature of intelligence predisposed them to support Burt's critics.

In a favorable review of Joynson's book in *Contemporary Psychology*, the journal of reviews of the American Psychological Association, Sandra Scarr concluded that Burt was careless, thus rendering his data useless; that he may have been devious, was an avowed hereditarian and certainly was arrogant, imperious, and always opinionated. But that does not constitute proof of scientific fraud. In a detailed, fair, and balanced review of the Joynson and Fletcher books, Franz Samelson concluded:

> I do believe that Burt made things up about the twins, about factor analysis,[9] and about

[9] Hearnshaw (1979, p. 169) had charged that Burt exaggerated his role in developing the correlation coefficient and minimizing the contributions of Karl Pearson and Charles Spearman. Burt is hardly unique in exaggerating his own contributions at the expense of others.

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The Cyril Burt Affair (Continued)

parent-child data used in his "social mobility" study. Having analyzed Burt's many publications, I find too many omissions in his references, too many inconsistencies among different articles, and definitely some clear contradictions between what he had written at one time, and what thirty years later he claimed to have written earlier—although he may not be unique in doing so. (Samelson, 1992, p. 230)

Bert Green, in a feature review in *Psychological Science,* the leading journal of the American Psychological Society, reviewed the Hearnshaw, Joynson, and Fletcher books and asked whether the Burt affair had been an exposé or a smear (Green, 1992). He concluded that the charge that Burt deliberately falsified data on the inheritance of intelligence can neither be established nor disproved with certitude. But Burt certainly published data of such poor quality that they could not support his conclusions. More critical of Burt were Mackintosh (1995) who labeled his results "improbable" and the explanations given "implausible" and Tucker, who concluded after a detailed reconsideration of Burt, "there was little doubt Burt had committed fraud" (Tucker, 1997, p. 145).

wait. Later writers, influenced by the spirit of the times, popularized the test results and stimulated much controversy.

Debates and controversies over testing during the 1920s were the forerunners of similar debates and controversies in later decades. In the 1940s, some made charges of social bias in the tests (Davis, 1949). In the 1950s, controversy erupted over a program organized in the 1940s by "Mr. British Psychology," Sir Cyril Burt, in which 11-year-old children were given the 11-plus examination. On the basis of their test scores, they were "streamed" into trade schools preparing students for apprenticeships in the trades, grammar schools preparing students for white-collar careers, or schools preparing students for university entrance and professional careers (Vernon, 1957). All of this at the age of 11. Largely because of the inflexibility of "streaming," the 11-plus program was a social and educational disaster. Neil Kinnock, the leader of the British Labour Party and a man who had himself failed the 11-plus examination, described it as the mark of Cain put on working-class children and went on, "Nobody who has observed a community that operates a selective 11-plus can doubt that on the morning of the results there are not faces of children wreathed in smiles but there are floods of tears in many homes" (Kinnock, in Harris, 1984, p. 126).

The 11-plus has since been abandoned. Currently, the British have a single national test of educational achievement given at age 16. Under a proposed plan, nationwide testing will occur at ages 7, 11, 14, and 16 (Bencivenga, 1987).

In the 1960s, some made charges of racial bias in intelligence testing (Williams, 1970), and Arthur Jensen asked a provocative question in the *Harvard Educational Review:* "How much can we boost IQ and scholastic achievement?" (Jensen, 1969). Jensen's answer—"not much"—and his conclusion that IQ scores are 60 to 90 percent determined by genetics echoed the past and provoked a still-unresolved debate over testing and the interpretation of test results. In the 1970s, this debate over "Jensenism" continued with an exchange of charges (Herrnstein, 1971) and countercharges (Kamin, 1974).

RECENT DEVELOPMENTS IN INTELLIGENCE TESTING

The psychometric-correlational approach continues to dominate the measurement of intelligence (Carroll, 1993), but several recent approaches are based in psychology's cognitive revolution (Gardner, 1985). Intelligence can just as easily be viewed as a cognitive construct as it can be viewed as a trait construct. More concretely, cognitive-experimental researchers of intelligence now study the declarative and procedural knowledge structures that underlie intelligent behavior, including performance on intelligence test items. Earl Hunt, Robert Sternberg, and Howard Gardner are three contemporary psychologists who have proposed different cognitive perspectives on intelligence.

Hunt is one developer of an approach to intelligence called the *cognitive-correlates approach* (Hunt, 1978; Pellegrino & Glaser, 1979). This approach correlates scores on cognitive tasks (for example, memory scanning or letter matching), usually expressed in terms of response time (Chapter 4), with scores on standard psychometric measures of cognitive ability. The resulting correlations are used to infer the components of intelligence, although the magnitude of the observed associations fluctuates. Hunt and his colleagues have extensively studied the "mechanics" of verbal ability, using extreme group designs (high or low scorers on standardized verbal ability measures) and proceeding under the assumption that individual differences in cognitive representations and operations comprise the core of intelligence.

Sternberg is the major proponent of the *cognitive-components approach,* having devoted twenty years to the programmatic study of intelligence using cognitive methods. In his earlier research, Sternberg (1977) studied performance on analogy items of the form W : X :: ? : ? (W is to X as ? is to ?). His analyses suggested that performance on analogy items could be decomposed into the following stages or sequence of cognitive processes: (a) encoding, (b) inference, (c) mapping, (d) application, (e) justification, and (f) response preparation. He has even been able to estimate the proportion of observed response time associated with each of these subprocesses, and has found that encoding takes up approximately half of the entire response time. From this base, Sternberg (1985) proposed a triarchic theory of intelligence with contextual (environmental), experiential (learning), and componential (cognitive) factors. The specific components Sternberg has identified include meta-components, knowledge acquisition components, and performance components. The former are executive routines that invoke, receive, and integrate output from lower-level processes (for example, perceptual comparisons, memory scanning). Knowledge acquisition components are systems that permit learning from the environment. Performance components are involved in response organization and production.

Gardner's (1983) framework for conceiving intelligence is based on a literature survey for the *Project on Human Potential.* The resulting framework is

The Bell Curve Revisited

The Bell Curve, published in 1994, is arguably the most controversial book published in the history of psychology. Its authors were Richard Herrnstein, a Harvard professor of psychology and former student of Skinner (Chapter 13) best known for his research on operant conditioning; and Charles Murray, a political scientist at the American Enterprise Institute. The book's subtitle, *Intelligence and Class Structure in American Life,* foreshadowed the controversy the book would stimulate. Herrnstein and Murray, well aware of such portents, wrote in their Preface:

> We are not indifferent to the ways in which this book, wrongly construed, might do harm. We have worried about them from the day we set to work. But there can be no real progress in solving America's social problems when they are misperceived, as they are today. What good can come of understanding the relationship of intelligence to social structure and public policy? Little good can come without it. (Herrnstein & Murray, 1994, p. xxiii)

In 552 pages of text, seven appendixes, and more than one hundred pages of notes, these authors assert that people differ in intelligence and that intelligence has a powerful effect on how well people do in life. They argue further that differences in intellectual capacity exist among groups and that those differences have resulted in the emergence of a "cognitive elite" in the United States. Finally, Murray and Herrnstein predict that in the twenty-first century, differences in intelligence—or more generally, cognitive ability—will lead inevitably to the increased stratification of modern societies.

In November 1994, in response to *The Bell Curve,* the Board of Scientific Affairs of the American Psychological Association established a task force to examine the book's conclusions and the data upon which they are based. The chairman was Ulric Neisser, with ten psychologists as members. In February 1996, they introduced their report, "Intelligence: Knowns and Unknowns," with these words:

reminiscent of earlier debates between Spearman and Thurstone pertaining to the generality or multiplicity of intelligence. Spearman held that *g* is unitary or monarchic, while Thurstone maintained that intelligence is comprised of multiple factors (or is *oligarchic,* in Spearman's terminology). Gardner (1983) calls his approach the theory of multiple intelligences. It consists of nine frames divided into object-free, object-dependent, and personal categories. The *object-free* frames are linguistic and musical, with the latter one of the earliest to appear during development. *Object-dependent* frames are logical-mathematical, spatial, body-kinesthetic, and naturalistic, with dependence relating to symbolic systems, the proprioceptive internal environment, and the external environment. Lastly, *personal* frames include intrapersonal (self), interpersonal (others), and existential. Another illuminating aspect of Gardner's theory is the breadth of evidence cited in its support. Included are studies of brain dam-

The Bell Curve Revisited (Continued)

In the fall of 1994, the publication of Herrnstein and Murray's book *The Bell Curve* sparked a new round of debate about the meaning of intelligence test scores and the nature of intelligence. The debate was characterized by strong assertions as well as by strong feelings. Unfortunately, those assertions often revealed serious misunderstandings of what has (and has not) been demonstrated by scientific research in this field. Although a great deal is now known, the issues remain complex and in many cases still unresolved. Another unfortunate aspect of the debate was that many participants made little effort to distinguish scientific issues from political ones. (Neisser et al., 1996, p. 77)

Their report addressed five important questions:

- What are the significant conceptualizations of intelligence?
- What do intelligence test scores mean, what do they predict, and how well do they predict it?
- Why do individuals differ in intelligence? (Their discussion implicates both genetic and environmental factors.)
- Do ethnic groups show different patterns of performance on intelligence tests? If so, what might explain those differences?
- What scientific issues are presently unresolved?

After a thorough consideration of each of these questions and the relevant evidence, the authors conclude:

In a field where so many issues are unresolved and so many questions unanswered, the confident tone that has characterized most of the debate on these topics is clearly out of place. The study of intelligence does not need politicized assertions and recriminations; it needs self-restraint, reflection, and a great deal more research. The questions that remain are socially as well as scientifically important. There is no reason to think them unanswerable, but finding the answers will require a shared and sustained effort as well as the commitment of substantial scientific resources. Just such a commitment is what we strongly recommend. (Neisser et al., 1996, p. 97)

age (general and localized), of developmental changes, and of semiotics (Gardner, 2001).

The perspective the cognitive framework provides has enabled theoretical advances, but the pragmatic problems of measurement remain. Specifically, there are few alternatives to group-administered standardized tests, although computerized administration and scoring holds some possibility of progress for the future. Intelligence is a construct with numerous behavioral correlates having important real-world implications (Schmidt & Hunter, 1993). Because of the well-known group differences on standardized ability tests (Jensen, 1980), there is pressure from special interests that leads to public controversies concerning "quotas" for members of certain groups and "race-norming." Intelligence testing has a controversial past, remains controversial today, and no doubt will remain so for many years to come.

John Watson.
(Culver Pictures)

CHAPTER 12

The Research of Ivan Pavlov and the Behaviorism of John B. Watson

In his research conducted before, during, and after the Russian Revolution of 1917, Pavlov established the paradigms of classical conditioning and reported results that are basic to an understanding of learning (Roscorla, 1988). Pavlov had wide research interests. Without planning to, he became an important influence on the historical development of psychology. In the United States, Watson, too, was involved in a revolution, but in his case it was a revolution within psychology that he initiated and led. While his career in psychology was relatively short, Watson's *behaviorist* revolution had a major influence on the development of psychology, especially in the United States.

IVAN PETROVICH PAVLOV (1849–1936)

Pavlov's Early Life

Pavlov was born on September 14, 1849, in the small town of Ryazan in central Russia, the son of a clerical family (Babkin, 1949; Asratyan, 1953). His mother was the daughter of a Russian Orthodox priest. Pavlov's paternal grandfather had been the village sexton, and his father was a parish priest in one of the poorer districts of Ryazan. In nineteenth-century Russia, clerics formed a separate class of "pure Russians." Pavlov was proud of his family heritage and was intensely patriotic all his life. He was the oldest child in a family of eleven children, six of whom died young. As a boy, Pavlov attended the local school and then an ecclesiastical seminary. There he read two books that caused him to abandon his plans to enter the priesthood: Charles Darwin's *Origin of Species* (1859) and Ivan Mikhailovich Sechenov's *Reflexes of the Brain.* (More on the influence of Sechenov's book later.) Pavlov always acknowledged Darwin's influence and had an ecstatic, almost mystical, regard for him. When Pavlov, in the last years of his life, organized a research station at Koltushi outside Leningrad, he established it on a large country estate he called the "Soviet Down" in homage to Darwin's country home.

Pavlov left the seminary in 1870 without qualifying as a priest. He then enrolled in the faculty of natural science at the University of St. Petersburg. Nineteenth-century Russia was a largely agrarian society, and most of its population were illiterate peasants. A large percentage of Russia's educated and cultured people lived in St. Petersburg, and the city was a center of intellectual, social, and artistic life. Czar Nicholas II held court there, and the city's Hermitage Art Museum was world-famous. Aleksandr Borodin, the composer of the opera *Prince Igor,* was a resident of the city. In addition to being a distinguished composer, he was also a professor of biochemistry at the university. Dimitry Mendeleyev (1834–1907), who established the periodic table of the elements, was St. Petersburg's professor of chemistry. Pavlov's brother Dimitri worked in Mendeleyev's laboratory.

I. M. Sechenov (1829–1905) was the professor of physiology. He had studied with the leading nineteenth-century French physiologist Claude Bernard (Chapter 3). In Bernard's Paris laboratory, Sechenov had demonstrated that a salt crystal or electric current applied to the cut end of a frog's spinal cord inhibits spinal reflexes. Sechenov's experiment was a classic demonstration of a higher center's inhibition of the activity of a lower one. Such a hierarchical model of nervous activity was to be central to Pavlov's theories. In his book *Reflexes of the Brain,* published in 1866—publication was delayed because the ecclesiastical authorities feared that the clearly written book would be widely read and might undermine the faith of many people—Sechenov argued that all physical acts are reflexes resulting from a combination of excitation and inhibition. The key to an understanding of the human psyche would be an understanding of the reflexes of the brain:

> The new psychology will have as its basis, in place of the philosophizings whispered by the deceitful voice of consciousness, positive facts or points of departure that can be verified at any time by experiment. And it is only physiology that will be able to do this, for it alone holds the key to the truly scientific analysis of psychical phenomena. (Sechenov, 1866, in Frolov, 1938, p. 6)

Pavlov adopted such views as his own.

Pavlov's Early Research

Pavlov graduated in 1875 with a degree in natural science. He had a brilliant record as a research student and won a gold medal for his research on the pancreatic nerves. He was appointed to the St. Petersburg Military Academy and the Veterinary Institute. In 1878, S. P. Botkin, another St. Petersburg luminary and a professor of internal medicine, invited Pavlov to take charge of a newly opened laboratory of experimental medicine. Botkin was best known for his theory of *nervism,* which held that the nervous system regulates most bodily functions. Botkin believed most diseases were the result of the central nervous system's failure to adapt the organism to the demands of life; these failures were usually due, he argued, to an excessive reaction to stress and threat. Botkin also believed that all life shares common elements—for example, basic proteins—and that different life forms are distinguished by their particular organization of these elements. Botkin taught a scientific approach to medicine and biology that started at the simplest levels of organization and worked towards the more complex. That was the approach Pavlov would follow in his research.

The laboratory Botkin provided was little more than a shed in the garden of the medical clinic. The laboratory was small and poorly equipped, but in it Pavlov did important research on the cardiac nerves. He was able to demonstrate that the cardiac nerves are capable not only of increasing and decreasing heart rate, but also of augmenting or diminishing the force of each heartbeat. They thus have a dual function. Pavlov was awarded an M.D. degree in 1883, and his cardiac research was recognized with a second gold medal. He then spent three years working in Germany. The four years following his return to Russia were a time of hardship. His applications for a number of academic positions were denied, and Pavlov was forced to live hand-to-mouth. Often he and his family had little food and sometimes no heat in their apartment during the Russian winter. Still he struggled to continue his research, often keeping experimental animals in his apartment. Once, while Pavlov was studying the transformation of chrysalides into butterflies, the insects died from the cold. When his wife complained about their poverty, Pavlov replied, "Oh, leave me alone, please. A real misfortune has occurred. All my butterflies have died, and you are worrying about some silly trifle" (Babkin, 1949, p. 26).

These difficult years ended when Pavlov was appointed chair of pharmacology at the St. Petersburg Military Academy. In 1891, he organized the Institute of Experimental Medicine in St. Petersburg, where he conducted his research for the next forty years. On seeing Pavlov's laboratory in 1901, B. P. Babkin (1949) recalled that it seemed an unimposing place. But that appearance was deceptive, for Pavlov's research on digestive processes, carried out in this laboratory, was to win him the 1904 Nobel Prize. In 1895, Pavlov was appointed professor of physiology at the University of Saint Petersburg; in 1901, he was elected a corresponding member of the Russian Academy of Sciences, and in 1907 he became a full member, or Academician. Pavlov had reached the pinnacle of Russian academic and scientific life, but not without a struggle.

Pavlov's Conditioning Experiments[1]

In his research, Pavlov constantly sought to find "windows" onto functioning physiological systems—cardiac, digestive, and cortical. Acute vivisectional methods had their place, but all too often they seemed to shatter the body's inherent mechanisms, thwarting Pavlov's aim to observe living systems. He developed stringent surgical procedures modeled on those used in humans; his dogs went through four surgery-preparation rooms before an operation. Not one instance of sepsis occurred in his laboratory, and that in an era without

[1] Windholz (1989a) gives a detailed description of Pavlov's discovery of the principles of reinforcement, extinction, generalization, and differentiation of conditioned reflexes. Windholz convincingly demonstrates that the development of these Pavlovian paradigms was not a highly systematic pursuit.

antibiotics. Pavlov was a skilled surgeon who never lost an animal in surgery. His first major success came in 1888, when he isolated a functioning mammalian heart. For the first time, the heart's action could be observed directly.

In his search for a window onto the digestive system, Pavlov developed an operation in which a "miniature stomach" was isolated from the rest of the organ in a pouch so that he could observe glandular activity in the dog's stomach without contamination from the food being digested. Many experimenters before Pavlov had tried to develop such a pouch. In Germany, Pavlov had studied the operative procedures of R. Heidenhain in Breslau, but Heidenhain's attempts had been unsuccessful. Pavlov, too, initially encountered many difficulties. His first nineteen operations failed, but in the twentieth animal, he isolated a miniature stomach in a pouch. Eventually Pavlov became so skilled at making this "Pavlov pouch" that the surgery was often over before observers realized it had begun. With a small part of the stomach externalized, Pavlov had a window onto the digestive system. He studied the composition of gastric juices when dogs ate different foods and when the esophagus was severed so that food did not reach the dogs' stomachs. Under these sham feeding conditions, the dog ate what Pavlov labeled a "fictitious meal," yet gastric juices began to flow some time after it began to eat. This gastric reflex occurred without the presence of food in the stomach; it was elicited by a higher center in the nervous system. Pavlov termed it a "psychical reflex."

Pavlov collected gastric juices from corked fistulas (tubes) implanted in the wall of the pouch. His dogs produced up to twenty liters of pure gastric juices each day; Pavlov referred to his laboratory as a "gastric juice factory." The ingenious Pavlov sold this juice to people with digestive problems as an aid to digestion, and these sales earned half the laboratory's annual research budget (Babkin, 1949, p. 69). Since the juice tasted vile and was of doubtful therapeutic value, Pavlov must have been a good salesman.

Pavlov reported his results in *Lectures on the Work of the Digestive Glands,* published in 1897 and in a paper at the International Congress on Medicine in Madrid, Spain, on April 28, 1903. These reports were a great success that earned Pavlov an international reputation and the Nobel Prize for medicine in 1904. No doubt the audience for his address as a Nobel laureate expected Pavlov to describe his experiments on digestion. Instead, he described what he had observed through his latest window: "psychical reflexes." Starting in 1891, Pavlov and his students began to pay attention to the gastric juices and saliva the dogs secreted at times other than when they were fed. At first, these responses were nothing more than "nuisances" that interfered with their studies of digestion (Anokhin, 1971, p. 48), but then Pavlov began to study them more systematically. In 1891, Georgi S. Ovsianitskii in his doctoral dissertation investigated the response of the salivary glands to a variety of stimuli (Windholz, 1986, p. 141). Ovsianitskii's method involved pumping serum into the salivary glands and observing the outflow from the salivary duct. To simplify the experiments, fistulas were implanted in the dogs' salivary glands, allowing saliva to be collected. Often dogs salivated when they saw but did not eat food, when they saw a bowl that often contained food, or even when they heard the foot-steps of the laboratory personnel who fed them. Since these were not the physiologically appropriate stimuli for salivation, Pavlov (1897) referred to them as "psychical stimuli."

Pavlov believed that study of these stimuli and the responses they elicited would bring the secrets of the cerebral hemispheres to light. Others were not convinced, and some of his fellow physiologists regarded his experiments as at best quasi-scientific. The great English physiologist Charles Sherrington once advised Pavlov to return to real physiology, though he later acknowledged the importance of Pavlov's research (Sherrington, 1941, p. 286).

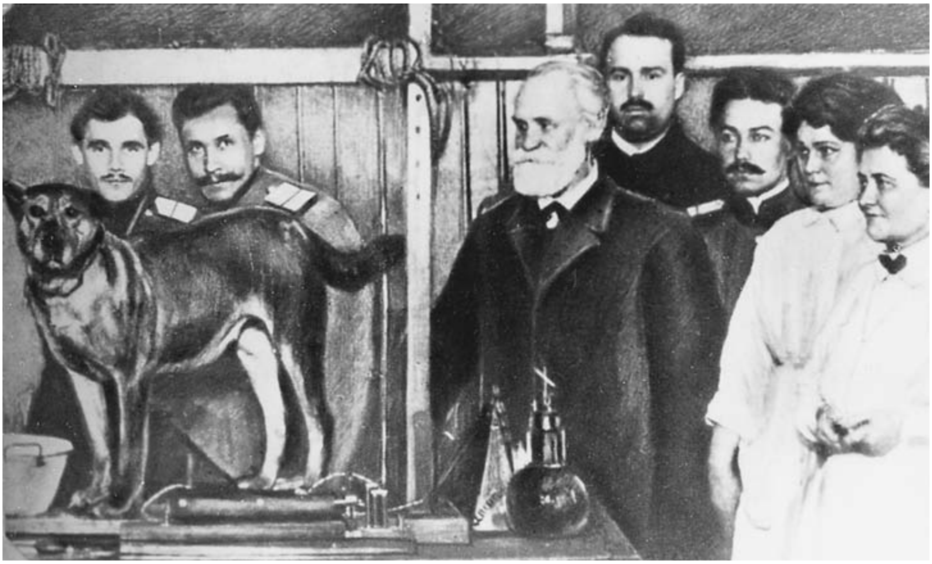
In his experiments, Pavlov (1927) used a variety of stimuli to be conditioned, or conditioned stimuli (CSs): metronomes, buzzers, and tactile and thermal stimuli.[2] He went to great lengths to isolate his animals from all stimuli other than the ones under study. Pavlov designed a special laboratory, his "Tower of Silence," with walls insulated with two feet of turf, and he tested his dogs in double chambers isolated from the experimenters. A CS was presented just before the dog was fed. After a number of these pairings, Pavlov observed that the stimulus alone would elicit salivation. This response he termed the conditioned reflex (CR). Pavlov had established a procedure in which a variety of stimuli acquire the power to elicit reflex responses. Buzzers, metronomes, and tactile and thermal stimuli do not normally elicit salivation; it is only after conditioning that they have the power to do so.

In 1906 Nadezhda A. Kashereninova Pavlov observed that once a CR had been established to one CS, other, similar stimuli that had not been paired with the food would also elicit the response (Windholz, 1989a). A dog conditioned to respond to a metronome at 90 beats per minute (b.p.m.) would also produce CRs to the sound of metronomes at 100 and 80 b.p.m. A dog conditioned to respond to a tactile stimulus on the middle of the leg would also respond to stimuli at other points on the leg. The CR had generalized from the original CS to similar stimuli. The intensity of the response decreased as the distance from the original CS increased. That generalized response to graded stimuli is the generalization gradient.

Pavlov's research showed secondary conditioned reflexes could also be established. Once a CR had been formed, a novel stimulus paired with the original CS a number of times could elicit the same CR. This was especially interesting, since the secondary CS had never been paired with the physiologically appropriate stimulus, the food.

In 1902 Pavlov's co-worker Ivan P. Tolochinov found that if a CS was presented repeatedly without food, for example, the conditioned reflex (CR) would weaken, a process he called *extinction* (Windholz, 1989a). He discovered that this procedure could be used in conjunction with reinforcement to train a dog to discriminate between stimuli. If food always followed a metronome of 100 b.p.m. (CS+) and never followed a metronome of 60 b.p.m. (CS–), a dog would secrete little if any saliva to CS– and copious amounts to CS+. Pavlov

[2] In many textbooks, Pavlov is said to have used a bell as a CS, but that is in dispute. Catania (1994) claimed that he never did; Thomas (1997) asserts that he did.



Ivan Pavlov with his students and research assistants in his laboratory. The dog stands in a "Pavlov harness" for the conditioning experiments.
(The Bettmann Archive)

believed that the two stimuli produced either excitation or inhibition in the cortex. At times the effects of this inhibition were obvious. When CS– was presented many times, some dogs became drowsy and eventually fell into a "deep, snoring sleep." When CS+ was again presented, it was necessary to "stir up the dog" before it would respond. Sleep was also observed when long intervals separated the CS and the food during conditioning.

Howard Liddell, an American student working in Pavlov's laboratory, did a fascinating variation of this discrimination procedure (Liddell, cited by Lorenz, 1969, in Pribram, 1969; additional details from Gantt, 1975). Liddell conditioned a dog to discriminate between accelerating (CS+) and decelerating (CS–) metronomes. Once the dog had learned this discrimination, Liddell freed it from the conditioning harness. When the CS+ was presented, the dog ran over to the metronome, barked, whined, and begged from it; when the decelerating CS– was presented, the dog placed its paw on the pendulum and appeared to be trying to speed up its back-and-forth motion.

Pavlov also tested the limits of his dogs' ability to discriminate between stimuli. He found that they could not discriminate between colors and so concluded that dogs are colorblind. A dog trained to discriminate between metronomes of different rates salivated to one at 82 b.p.m. but not to one at 78 b.p.m.—an exquisite discrimination. Similar fine discriminations were conditioned between different thermal and tactile stimuli and between wheels that rotated either clockwise or counterclockwise. Some discriminations, though, were too difficult for the dogs to make. The dramatic change in their behavior at such times led Pavlov to an interest in "experimental neuroses."

Pavlov's Research on Neuroses

In 1921, one of Pavlov's students, Nataliia R. Shenger-Krestovnikova,[3] trained a dog to discriminate between a circle and an ellipse. At first the figures were very different, and the dog easily learned the discrimination. Then the ellipse was made progressively more circular. The dog was finally able to discriminate between a circle and an ellipse with axes in a ratio of 8 to 7, a remarkably acute discrimination. However, when Shenger-Krestovnikova changed the ratio to 9:8, she saw a dramatic change in the dog's behavior:

> The whole behavior of the animal underwent an abrupt change. The hitherto quiet dog began to squeal on its stand, kept wriggling about, tore off with its teeth the apparatus for mechanical stimulation of the skin, and bit through the tubes connecting the animal's room with the observer, a behavior which had never happened before. On being taken into the experimental room the dog now barked violently, which was also contrary to its usual custom; in short, it presented all the symptoms of acute neurosis. (Pavlov, 1927, p. 291)

A second incident confirmed Pavlov's interest in neurotic behaviors. In September 1924, a big flood struck Leningrad (St. Petersburg's new Soviet name). Rising water trapped Pavlov's dogs in their kennels, and many of them had to swim to keep their heads above water. After their rescue, the dogs huddled together in small groups without any of their usual biting, growling, or play. The trauma of nearly drowning had apparently inhibited these behaviors. When returned to the conditioning apparatus, some of the dogs showed profound behavioral changes. Their CRs were erratic and easily disrupted, and they were acutely sensitive to certain stimuli, especially the sight and sound of water. When a mere trickle of water ran into the experimental chamber, a dog became disturbed and fought to escape from the conditioning harness. Water was an overwhelmingly powerful excitatory stimulus (Gantt, 1973).

A related line of research was conducted by Mariia K. Petrova starting in 1925 (Windholz, 1989b, pp. 495–496). Petrova used two dogs, one very excitable, the other abnormally subdued. The experimental neurosis was created by simultaneously presenting food and an electric shock. The defensive response to shock competed with the approach response to food, creating conflict. The dogs' established conditioned discriminations broke down. Petrova attempted to treat the neurosis by administering sodium bromide. The excitable dog improved, whereas the subdued dog did not. The bromide was thought to have strengthened the inhibitory process in the excitable dog and thus to have restored the balance between excitation and inhibition. In the subdued dog, the bromide had evidently increased inhibition, creating an even greater imbalance between the two processes.

Pavlov was so impressed by these stress- and conflict-induced neurotic behaviors that, at the age of 75, he decided to study human clinical disorders. He spent much of the last decade of his life trying to apply the lessons he had

[3] Early in his career, Pavlov opposed admitting women to his laboratory. But in 1905 he changed his position, and eventually there were at least twenty women among the Pavlovians (Windholz, 1990, p. 66).

learned from his conditioning experiments with dogs to understanding the causes of human psychological disorders. One of Pavlov's last major presentations, an address to the International Neurological Congress in London in July 1935, was on neuroses and psychoses.

Pavlov's Views on Individual Differences

Early in his conditioning experiments, Pavlov found large individual differences between animals in regard to the speed and strength of conditioning. Some dogs conditioned quickly, some slowly; some dogs extinguished quickly, some slowly. Similarly, some dogs generalized freely, others very little; some dogs learned discriminations with ease, others with great difficulty; some dogs were resistant to experimental neurosis, others were not. Pavlov concluded that dogs differ in the strength, balance, and lability of the excitatory and inhibitory processes in their nervous systems. In describing the results of his research, Pavlov paid close attention to individual differences. He never averaged the results over several dogs but always reported the varying results from single animals (Eysenck, 1983, p. 117).

Pavlov described four basic "types" of dog, using the ancient typology of Hippocrates (Chapter 1) (Pavlov, 1928):

1. *Sanguine* dogs were strong, lively, and active. They conditioned quickly, learned discriminations with ease, and generalized extensively. They had a "calm, businesslike approach" to the conditioning experiments and were excellent experimental animals. Pavlov believed excitation and inhibition were in balance in their nervous systems.
2. *Melancholic* dogs were slow and depressed. They conditioned slowly and showed poor generalization and discrimination. Inhibition seemed dominant in these dogs.
3. *Choleric* dogs were unstable and impetuous. They conditioned quickly and generalized widely, but had difficulty with discriminations and showed little resistance to experimental neurosis. Pavlov believed that excitation was excessive in their nervous systems.
4. *Phlegmatic* dogs were inert and slothful. They conditioned slowly and showed poor generalization and discrimination but were resistant to experimental neurosis. In these dogs, Pavlov believed, inhibition was dominant.

While Pavlov found the *sanguine* and *melancholic* types were most common, all dogs were different. He believed that these differences were largely genetically determined, but he did not ignore environmental influences, or what he termed the "education" the dogs received early in life. Pavlov raised littermate puppies in two different conditions: (1) almost total freedom, with many and varied contacts with other dogs and humans and (2) isolation in individual cages with as little contact as possible. At the age of three months, the "prisoners," as Pavlov called the isolated dogs, were afraid of everything and had a very strong orienting reflex that was difficult to extinguish compared with the dogs raised in the first condition. However, the "prisoners" habituated more easily to the isolation of a sound-deadened experimental room (Giurgea, 1985, p. 9). This research was a clear precursor of the investigations of Donald Hebb, Robert Melzak, and Mark Rosenzweig on the effects of deprived and enriched environments on behavior and brain chemistry.

Pavlov's Later Life

Pavlov lived before, during, and after the Bolshevik Revolution. Before 1917, he was a moderate liberal but had little interest in politics. Initially Pavlov was hostile to the Bolsheviks; he once said of their revolution:

> It is the greatest misfortune sustained by Russia. . . . If that which the Bolsheviks are doing with Russia is an experiment, for such an experiment I should regret giving even a frog. (Pavlov, quoted by Babkin, 1949, p. 161)

Pavlov had a personal reason for animus toward the new regime. He had deposited his Nobel Prize award of 73,000 gold rubles in a St. Petersburg bank. After the revolution, the Bolsheviks liquidated the bank's assets, and Pavlov lost his money. Despite his hostility, the Bolsheviks flattered and supported Pavlov. They saw his research as proof that people could be conditioned to serve the worldwide proletarian revolution. In 1921, a decree over Lenin's signature stated:

> Taking into consideration the very exceptional services of Academician I. P. Pavlov, which have enormous significance for the workers of the whole world, the Soviet of People's Commissars has decided:
>
> 1. To direct a committee to create as soon as possible the most favorable conditions for safeguarding the scientific work of Academician Pavlov and his collaborators.
> 2. To direct the Government Publishing House to print in the best printing house of the Republic an *édition de luxe* of the scientific work produced by Academician Pavlov and his collaborators.
> 3. To direct the Committee of Provisions for Workers to supply to Academician Pavlov and his wife special rations equal in caloric content to two academic rations.
> 4. To direct the Petrosoviet to assure to Professor Pavlov and his wife the perpetual use of the apartment occupied by them and to furnish it and Pavlov's laboratory with the maximum conveniences. (Decree of the Soviet of the People's Commissars, January 24, 1921; in Babkin, 1949, p. 165)

Shortly after this decree was issued, famine struck the Soviet Union. Pavlov refused to accept extra rations unless his coworkers and the laboratory animals were adequately fed. When the authorities refused, Pavlov rejected the extra food and cultivated a garden next to his laboratory. By 1923, Pavlov was so unhappy with the new regime that he requested permission to leave Russia permanently. He had friends in both England and the United States and hoped to transfer his laboratory to either country. Permission was denied, but he was allowed to visit the United States in 1923. His visit was marred by his loss of $2,000 in New York City, as reported by the *New York Times:*

> He [Pavlov] and his son [Vladimir] had hardly taken their seats on the train in Grand Central Station when three men set upon the old man and snatched from him his pocketbook containing all their funds, $2,000. The porter and son attempted to catch them but were unsuccessful, and the old man and his son left the train perplexed as to what they should do in their predicament. They finally got in touch with Dr. P. A. Levere of the Rockefeller Institute and since then have been guests of the institute. (*New York Times,* July 13, 1923, p. 3; in Thomas, 1997, p. 118)

On Pavlov's second visit to the United States, he attended the 1929 International Congress of Psychology at Yale University. Pavlov was in his eightieth year, frail and gray, but he presented a lively paper entitled "Brief Sketch of the Highest Nervous Activity" outlining his experiments and results. He spoke in Russian with a translator, and his lecture was warmly received. Psychologist Edna Heidbreder, who was in the audience, remembered:

> Pavlov seemed to be speaking with great enthusiasm, and the empathizing audience broke into enthusiastic applause without waiting for the translation. When the translation came, the applauded passage proved to be a description of some apparatus used in Pavlov's laboratory. (Heidbreder, in Duncan, 1980, p. 3)

During the conference, Robert Yerkes (Chapter 11) showed Pavlov around the Yale Primate Center. Unfortunately, one of the chimpanzees greeted the distinguished visitor with a shower of "material" from the cage floor. The ever-logical Pavlov, noticing that he was the only bearded person in the group, asked, "How did you condition the chimpanzee only to throw at people with beards?" (Fletcher, 1980).

In 1927, the Soviet regime expelled sons of priests from medical schools. Pavlov condemned this action, stating that if such students were expelled, he too, as the son of a priest, would have to leave. Despite such opposition, the regime supported his research, and Pavlov became more tolerant. At the Fifteenth International Congress of Physiologists, held in Moscow in 1935, Soviet officials hailed Pavlov as the "world's greatest physiologist and a shining example of the triumph of Soviet science" (Asratyan, 1953). In his welcoming address to the delegates, Pavlov said:

> We, the directors of scientific institutions, are really uneasy and alarmed when we ask ourselves whether we shall be in a position to justify all the resources which the government places at our disposal. As you know, I am an experimenter from head to foot. My whole life has been given to experiment. Our government is also an experimenter, only in an incomparably higher category. I passionately desire to live, in order to see the completion of this historical social experiment. (Babkin, 1949, p. 162)

Why did Pavlov change his political views to accommodate the new regime? Two of his Soviet biographers, Aleksel Frolov (1938) and Ezras Asratyan (1953), explained Pavlov's change on ideological grounds. More convincing is Boris Babkin's (1949) explanation; he ascribed the change to Pavlov's intense patriotism and fear of Germany. Pavlov was intensely anti-German; in 1927, he even refused to allow a German surgeon to remove his gallstones. When Hitler came to power in Germany in 1933, Pavlov, along with most Soviet intellectuals and scientists, saw Germany as a terrible threat to their country. They supported the only government they had, the Bolsheviks.

Pavlov's Diverse Research

Pavlov's conditioning experiments are known to all students of psychology and are at least vaguely familiar to the general public. However, they were not the experiments for which he received the Nobel Prize, and Pavlov had varied research interests all his life. Between 1897 and 1936, at least 146 associates and students worked in his laboratory, 20 of whom were women (Windholz, 1989b, p. 495). A documentary film, *Scenes from Pavlov's Laboratory* (Stagner, 1972),[4] shows Pavlov and his students engaged in a wide range of research activities in addition to conditioning experiments with dogs: comparative studies of the behavior of fish, birds, and tortoises; field studies of animal and human behavior; and ingenious studies of problem solving by chimpanzees. Pavlov's chimpanzee research, though not well known, is fascinating (Windholz, 1984). In 1933, Pavlov received a gift of two chimpanzees from Paris. For the next three years, the animals were housed at the Koltushi research station, where they were given considerable freedom to roam the fields, parks, and forest. Experimental work with them was performed by P. K. Denisov but directed by Pavlov. The researchers gave the two chimpanzees tasks that required them to overcome various difficulties to reach food: opening a locked box, putting out a fire barring their way, building a pyramid of boxes to reach food suspended from the roof, and performing other tasks requiring a combination of these acts (Windholz, 1984, p. 26). Pavlov knew of Wolfgang Köhler's chimpanzee problem-solving experiments (Chapter 7) and had visited Köhler's Berlin laboratory. In some ways his experiments were similar, but he rejected Köhler's account of insight learning. Pavlov was more sympathetic to Edward Thorndike's description of trial-and-error learning (Chapter 10). Pavlov believed his animals were accumulating "practical experience," which they used to solve problems. In addition to this animal research, Pavlov, as we have seen, devoted the last decade of his life to clinical research.

Academician Pavlov

Pavlov had a self-described "passion for science." Carved in stone above the entrance to his new laboratory at Koltushi was the admonition "Observation—Observation." On the lawn, Pavlov personally erected busts of his three

[4] Pavlov directed this remarkable film first shown at the Fourteenth International Congress of Physiology in Rome in 1932. A ninety-minute reproduction of the original version, and a forty-five-minute abridgment suitable for classroom use, are available from the Archives of the History of American Psychology at the University of Akron.

scientific heroes: Mendel, Darwin, and Sechenov. He was punctual to a fault, totally devoted to science, and rather helpless outside the laboratory. Pavlov was never able to master train schedules and could not travel alone. As an example of Pavlov's dedication and priorities, Horsley Gantt (1975) recalled this incident during the Bolshevik Revolution:

> Pavlov had planned some experiments to be done with an assistant. They were planned for 9 A.M. and as was his custom, Pavlov walked three miles from his home to his laboratory, arriving promptly at nine. To his extreme annoyance, his assistant arrived ten minutes late. Pavlov angrily criticized the young man, who explained: "But Professor, there's a revolution going on with shooting in the streets!" Pavlov replied, "What the hell difference does a revolution make when you've work to do in the laboratory. Next time there's a revolution, get up earlier!" (Gantt, 1975)

Pavlov asked one potential coworker, I. V. Zavadskii, how much time he planned to spend in the laboratory. Zavadskii replied "as much as necessary" and was accepted immediately (Windholz, 1990, p. 65). Obviously, Pavlov was a severe taskmaster. "Happiness is nothing," he often said, "the dogs mean all" (Gerow, 1988, p. 3). Pavlov erected a statue to the dog on the grounds of the Institute of Experimental Medicine in Leningrad near the Tower of Silence. On the four faces of the statue's base are bas-reliefs showing scenes from Pavlov's laboratory. Pavlov also had that most redeeming of human qualities, a sense of humor. On one occasion, the demonstrations presented by his assistant, L. A. Orbeli, failed dismally during one of Pavlov's lectures. Pavlov was so angry that he castigated Orbeli in public, and Orbeli resigned. That evening Pavlov, already a Nobel laureate, went to Orbeli's home and told him, "I can't accept your resignation. You are my best assistant. Let us make a deal: you let me shout, don't pay attention, and do your work" (Giurgea, 1985, p. 8). Orbeli worked with Pavlov for the rest of his life and succeeded him as director of the institute. When he refused to support T. D. Lysenko's pseudoscientific dogma on the inheritance of acquired characteristics, Orbeli earned Stalin's enmity and was disciplined at a Joint Scientific Session of the USSR Academy of Science in 1950 (Windholz, 1997). Forced to apologize for his errors and for deviating from Pavlov, Orbeli never recovered from that traumatic experience. He died in 1958.

Another coworker could no longer bear Pavlov's insults and overbearing behavior. He asked to be relieved of his surgical duties. Pavlov responded that his abusive behavior was just a habit and that it should be treated like the smell of the dogs, meaning that it was not in itself a sufficient reason to leave the laboratory (Windholz, 1990, p. 68). When Pavlov visited Cambridge University to receive a doctor of science degree, the irreverent undergraduates presented him with a toy dog festooned with glass fistulas. Pavlov was delighted and kept the dog on his desk when he returned to the Soviet Union (Frolov, 1938). He enjoyed hard work and athletics all his life—they gave him, he said, "muscular gladness" (Gantt, 1973, p. 135). At the age of 86, Pavlov stated that he needed just fifteen more years to complete his research. He worked until four days before he died of pneumonia on February 27, 1936, and is said to have made notes on his own reactions in the hours before he died. Pavlov was given an elaborate funeral with full honors as a hero of the Soviet State. In 1949, the Soviet government marked the centennial of his birth with two commemorative stamps.

CONDITIONING BEFORE PAVLOV

Early Descriptions of Conditioning

Pavlov's place in the history of psychology is secure, but it is also true that descriptions of conditioning antedate his work. Weston Bousfield (1955) called attention to one such explicit description of conditioning by the seventeenth-century Spanish playwright Lope de Vega. In his play *The Chaplain of the Virgin,* Lope de Vega described a young monk's ingenious solution to a taxing behavioral problem:

> Saint Ildefonso used to scold me and punish me lots of times. He would sit me on the bare floor and make me eat with the cats of the monastery. These cats were such rascals that they took advantage of my penitence. They drove me mad, stealing my choicest morsels. It did no good to chase them away. But I found a way of coping with the beasts in order to enjoy my meals when I was being punished. I put them all in a sack, and on a pitch black night took them under an arch. First I would cough and then immediately whale the daylights out of the cats. They whined and shrieked like an infernal pipe organ. I would pause for a while and repeat the operation—first a cough, and then a thrashing. I finally noticed that even without beating them, the beasts moaned and yelped like the very devil whenever I coughed. I then let them loose. Thereafter whenever I had to eat off the floor, I would cast a look around. If an animal approached my food, all I had to do was cough, and how that cat did scat. (Bousfield, 1955, p. 828)

Mark Rosenzweig (1959) gave other examples of descriptions of conditioning before Pavlov. In a textbook on physiology published in the mid-eighteenth century, Albrecht von Haller noted that hunger alone can provoke the flow of saliva. In 1751, Robert Whytt (Chapter 3) wrote in his *Essays on Voluntary and Involuntary Motions of Animals:*

> Thus the sight, or even the recalled idea, of grateful food causes an uncommon flow of spittle into the mouth of a hungry person; and the seeing of a lemon cut produces the same effect in many people. (Whytt, 1763, p. 280)

In 1803, C. Dumas pointed out that copious saliva is often secreted at times when we are accustomed to eat. He termed such secretions *habits.* In 1852, F. Bidder and C. Schmidt reported that the sight or even the thought of food may provoke salivation. James Ward in an 1878 *Encyclopaedia Britannica* article explained that while the dog's mouth waters at the sight of food, the human gourmand's mouth waters at the thought of food. Claude Bernard in 1872 did an experiment in which a horse's parotid duct was exposed so that saliva could be collected. Bernard found that if he repeatedly waved his hand in front of the horse's face just before it was fed, eventually his hand movement alone would elicit a copious flow of saliva (Rosenzweig, 1959).

Edwin B. Twitmyer's Conditioning Experiments

In addition to these accounts, in 1902 the psychologist Edwin B. Twitmyer gave an explicit description of conditioning in humans. In his doctoral research directed by Lightner Witmer (Chapter 8) at the University of Pennsylvania, Twitmyer planned to study the effects of muscle tension on the magnitude of the knee-jerk (patellar) reflex in humans. He used a bell as a preparatory signal to warn his subjects that patellar hammers were about to fall on their patellar tendons. One day, while adjusting his apparatus, Twitmyer accidentally rang the bell without dropping the patellar hammers. To his very great surprise, the subject jerked his knees. Twitmyer described the event as follows:

> During the adjustment of the apparatus for an earlier group of experiments with one subject (Subject A), a decided kick of both legs was observed to follow a tap of the signal bell occurring without the usual blow of the hammers on the tendons. (Twitmyer, 1902, in Twitmyer, 1974, p. 1059)

When questioned, the subject reported that he had been conscious of the knee jerks but that they had been involuntary and subjectively identical to the responses elicited by the hammers. Reflex knee jerks had resulted from a stimulus other than the usual. Twitmyer realized the significance of this observation and made extensive tests with six additional subjects. After many presentations of the bell followed 150 milliseconds later by stimulation of the patellar tendon—the number varied between 150 and 238 pairings in different subjects—the bell alone elicited the knee jerk. The form of the responses to the bell was identical to that of the responses made when the patellar tendon was stimulated. When the subjects tried to inhibit their responses to the bell, they were unable to do so. Twitmyer wrote:

> The results of these experiments warrant the opinion that the occurrence of the kick without the blow on the tendons cannot be explained as a mere accidental movement on the part of the subjects. On the contrary, the phenomenon occurs with sufficient frequency and regularity to demand an inquiry into its nature. (Twitmyer, 1902, in Twitmyer, 1974, p. 1061)

Twitmyer promised to make such an inquiry but never did. Why not, and why has his work been so neglected?

Occasionally Twitmyer has been described as an example of a person who made an important discovery without appreciating its significance. Such descriptions are unfair to Twitmyer. His account of the conditioning phenomenon was explicit, and there is no doubt that he understood the significance of his finding. However, his dissertation was privately published and so was not widely read. Twitmyer presented a paper on his research at the 1904 meeting of the APA. His title, "Knee-Jerks Without Stimulation of the Patellar Tendon," should have alerted the delegates, but unfortunately it did not. He read his paper at the end of a long morning session that had produced much discussion of earlier papers. When Twitmyer's turn came, it was well past the scheduled lunch break. At the end of his presentation, William James (Chapter 9), the session's chairman, described Twitmyer's result as "another interesting example of learning" (Dallenbach, 1959, p. 636). He asked for comments or questions and, as there were none, adjourned the session. Many years later, Karl Dallenbach wrote in an eloquent appreciation of Twitmyer:

> His report, though presented before the elite of American psychology, fell dead. Not one of his hearers commented upon it after his presentation. The most important paper, as we now know, of that and many succeeding meetings of the Association was followed by—to Twitmyer—an embarrassing silence! A good chairman, after throwing the paper open for discussion would, particularly in the case of a young man giving his first report, have asked the first question to thaw the audience's reticence and to start the discussion rolling. Had James done that, the audience's reaction might have been different. Had Twitmyer received a spark of encouragement, he would have continued his investigation. Had he done that, "conditioning" might have had its effective beginning in America instead of Russia. "Of all sad words . . . the saddest . . . [are] it might have been!" (Dallenbach, 1959, p. 636)

Dallenbach's words were compassionate, but his attribution of priority to Twitmyer was incorrect. As we have seen, Pavlov and his students had begun their research in 1891, more than a decade before Twitmyer (Windholz, 1986). Twitmyer himself never claimed priority, but he did always look back on this experience with disappointment and dismay (Irwin, 1943, p. 452). Discouraged, he turned to other interests, especially the diagnosis and treatment of speech problems. He joined the staff of the psychological clinic at the University of Pennsylvania and in 1914 was made the director of the university's speech clinic.

As we have seen, the reaction to Pavlov's description of conditioning was very different. Pavlov spoke with the authority of a Nobel laureate; Twitmyer was an unknown young man. Pavlov coined an intriguing term, the *conditioned response;* Twitmyer's knee-jerk was not as compelling. Pavlov spent over forty years studying conditioning; Twitmyer never did another conditioning experiment. The contrast could hardly be more striking. However, Twitmyer's research was of high quality, and he was very much a victim of circumstance. In 1974, Twitmyer received well-deserved recognition when the *Journal of Experimental Psychology* reprinted his 1902 dissertation.

THE BEHAVIORISM OF JOHN BROADUS WATSON (1878–1958)

Of all the schools of psychology considered in this book, none is more closely associated with the name of one person than *behaviorism* is with John B. Watson. Watson defined behaviorism, established its subject matter and research methods, and for a dramatic decade was *the* American behaviorist. His life was one of great success and brilliant achievements, but also of personal and professional tragedy. John Watson hoped to cause a revolution in psychology, and he succeeded. He aimed to replace earlier concerns about the structure and functions of consciousness with the study of behavior. The subject matter of his behaviorism was the objective study of behavior rather than introspective studies of consciousness. The goals of Watson's behaviorism were the observation, prediction, and control of behavior in humans and other animals. Pavlov's conditioning principles provided an important foundation for Watson's behaviorist approach.

Watson's Early Life

Watson was born near Greenville, South Carolina, in January 1878, the fourth of six children. His mother, Emma Watson, was a pious woman who adhered strictly to fundamentalist prohibitions against drinking, smoking, and dancing. She made her son vow at an early age that he would become a minister (Creelan, 1974). In an appreciation of Watson written after his death, Robert Woodworth (Chapter 10) described Watson's father, Pickens Watson, as a "well-to-do farmer." Woodworth's description was characteristically kind, but not accurate. Watson's father was in fact a ne'er-do-well, a violent man of unsavory and notorious reputation. In 1891, when Watson was 13 years old, his father abandoned his wife and family to live with two Indian women on the outskirts of Greenville. Watson never forgave his father. Many years later, when Watson was rich and famous and his father was in his eighties, the younger Watson refused even to see him (Cohen, 1979).

As a young boy, Watson attended rural schools in Reedy River and White Horse, small towns in a region of the Carolina Piedmont facing agricultural decline, industrial expansion, and racial strife (Buckley, 1989). In 1890, his mother sold the family farm and the family moved to Traveler's Rest, closer to Greenville, where Watson attended high school. In his autobiography, Watson (1936) looked back at his high school years with "few pleasant memories" and pictured himself as lazy, insubordinate, vicious, and violent. He was in fact a poor student, constantly in trouble with both school and civic authorities. Watson was arrested twice, once for illegally firing a gun and once for racial fighting,[5] an activity that he remembered as one of his favorite pastimes. With his record of juvenile delinquency, nothing good might have been expected of the young Watson, yet he wanted desperately to attend college. All his life, Watson faced what he called "life's little difficulties" realistically. He realized that his academic record precluded any chance of regular admission to college, so he took the extraordinary step of arranging for a personal interview with the president of Greenville's Furman College. Perhaps because of the influence of his mother's church connections (Karier, 1986, p. 115), Watson's audacious plea for admission was successful, and he entered Furman in 1894 as a 16-year-old "sub-freshman." At the time, Furman College was slowly developing support from the local business community but still had strong ties to the Southern Baptists. Watson's announced intention was to study for the Baptist ministry. Soon, though, whatever religious vocation he had weakened. In the classic American path, Watson worked his way through college, holding a variety of menial jobs, including one as a janitor in the chemistry department. In his autobiography Watson gave a bleak picture of his years at Furman, claiming that

[5] The arrest of a white youth for racial fighting indicates that Watson's behavior must have been extreme even for the rural South in the late nineteenth century (Kornfeld, 1994).

college life had held little appeal, that his education had been worthless, and that he had few friends and was asocial. In fact, he was an honors student, and many women saw him as a handsome and attractive young man. Many years later, an older lady of my acquaintance described Watson as the handsomest psychologist she had ever met. At Furman, Watson took a full course load, including biblical studies, Greek, Latin, mathematics, and philosophy, which included psychology. Though his academic record was good, in his autobiography Watson downgraded his performance, reporting that in his senior year he was the only student able to pass the Greek exam, but only because he had crammed for hours before the exam, staying awake by drinking a quart of Coca-Cola syrup.[6] He also claimed to have passed his other subjects because he was able to manipulate his professors into practically writing his examination papers for him (Watson, 1936).

The material Watson liked best was the psychology in his philosophy courses. He was fortunate in having Gordon B. Moore as a teacher. Moore had spent a sabbatical at the University of Chicago in 1898 and was up to date on developments in psychology. Moore introduced Watson to the works of Wilhelm Wundt, Edward Titchener, William James, and the Chicago functionalists. Despite his respect for Moore, Watson, in his intransigent way, managed to cross him. One day Moore threatened to fail any student who handed in a paper with the pages backward. In his senior year, Watson tested Moore's threat, and, true to his word, Moore failed him. Watson had to stay at Furman an additional year, graduating in 1899 with a master's degree. Watson described his emotions when Moore failed him:

> [I] made an adolescent resolve then to the effect that I'd make him seek me out for research some day. Imagine my surprise and real sorrow during the second year of my stay at Hopkins, when I received a letter from him asking to come to me as a research student. Before we could arrange it, his eyesight failed, and he died a few years later. (Watson, 1936, p. 272)

After graduating, Watson taught for a year at "Batesburg Institute," his contrived name for a one-room school in Greenville (Cohen, 1979, p. 19). His salary was $25 a month. Not only did the school have just one room, it had one teacher, one principal, one janitor, and one handyman—and Watson was all of them. He was a talented teacher, popular with the children and able to teach in a lively and interesting way. For his biology classes, Watson trained a couple of rats to do tricks—his first encounter with the animals that were to figure so prominently in his early career as a psychologist. However, teaching was only a temporary diversion, as he realized the need for more education at a "real university." Moore had moved to the University of Chicago and encouraged

[6] Fifteen years later, the federal government filed suit against the Coca-Cola Company for including a deleterious ingredient, caffeine. A psychologist, Harry Hollingsworth, received a contract from the company to investigate the behavioral effects of caffeine. The results of this pioneering psychopharmacological research did not influence the trial decision, but the judge, media, and other scientists recognized the research for its sophisticated experimental design and proclaimed it superior to the subjective, anecdotal methods of medical investigators (Benjamin, Rogers, & Rosenbaum, 1991).

Watson to apply for admission as a graduate student. Watson personally petitioned President William Rainey Harper (Chapter 9) for a graduate fellowship to attend the university. He was accepted, and in 1900 he traveled to Chicago with $50 in his pocket and vague plans to study philosophy and possibly psychology. Eight years later, Watson left Chicago for a chair in psychology at Johns Hopkins University in Baltimore. By that time he had a national reputation as a comparative psychologist, truly a remarkable achievement for a young man from Greenville. It has been said that:

> The Hall of Fame is high and wide
> The waiting room is full
> But some go in through the door marked *Push*
> And some through the door marked *Pull.*

Clearly Watson used the door marked *push.* He was a self-made American original determined to make a name for himself as a psychologist.

Watson at the University of Chicago

At Chicago, Watson first majored in philosophy, taking courses with Moore and John Dewey (Chapter 10). However, he soon realized that philosophy was not for him:

> I passed my exams, but the spark was not there. I got something out of the British school of philosophers—mainly out of Hume, a little out of Kant, and, strange to say, least of all out of John Dewey. I never knew what he was talking about then, and, unfortunately for me, I still don't know. (Watson, 1936, p. 274)

Nearly thirty years after taking his courses, Watson was to describe Dewey's views on education as a "doctrine of mystery" (Watson, 1928b). The missing stimulus to Watson's intellectual development was provided by James Rowland Angell (Chapter 10), who seemed to Watson the "real psychologist" he sought and the very model of the erudite professional man he hoped to become.

At Chicago, Watson worked hard, supporting himself with a variety of jobs: waiter in a boarding house for his room and board, janitor in the department of psychology, and caretaker in the animal laboratory of the Chicago neurologist Henry H. Donaldson (1857–1938). Watson was always short of money and many weeks survived on $6 or less. In Donaldson's laboratory, Watson not only cared for the rats but also learned some neurological and physiological testing procedures. Watson owed much to Angell and Donaldson and later dedicated his book *Behavior* (1914) to them. Watson also studied biology and physiology under Jacques Loeb (1859–1924). Loeb was an authority on *tropisms,* unlearned orienting reactions toward or away from stimuli. Some plants orient toward the sun, a *heliotropic* response; some insects crawl up a wall, a negative *geotropism* away from earth and its gravity; other species crawl down the wall, a positive *geotropism.* Loeb believed that much animal, and even some human, behavior consists of such mechanical responses, a belief that Watson was to accept and elaborate upon.

Watson's Early Research

Watson's dissertation research was directed jointly by Angell and Donaldson. Beginning in 1901, Watson investigated the relationship between the increasing complexity of behavior in the growing rat and the development of its nervous system. He trained rats of different ages to run around a box, cross a plank, or run through a labyrinth. Rats as young as twelve days old could learn to find their way around a box or cross a plank to reach their mothers, but in the labyrinth they curled up and went to sleep. Older rats successfully learned to make their way through labyrinths with many entrances and exits. Watson concluded there is a significant change in the rat's "psychical life" around the age of twenty-four days.

In the second phase of this research, Watson investigated the relationship between this change in intelligence and changes in the brain. Rats aged one to thirty days were sacrificed, and their brains examined. In rats twenty-four days old, Watson observed a great increase in the number of medullated fibers in the cortex. He suggested that this might be the neurological basis for the older rats' more complex performance. Watson's experiments went well and his conclusions were important, but his research was very demanding. Watson was very much on his own, with no established literature on experimental techniques to which he could refer. He built his apparatus himself, ran the experiments, and even shared his food with the rats. When they found their way out of the labyrinth, Watson gave them a piece of bread dipped in milk; when they did not, he often ate the bread and drank the milk. He enjoyed working with rats and felt that he understood their behavior; they were "bright, intelligent little fellows," often "playful" but at times "a picture of discouragement" (Watson, 1903). It is difficult for people who are not "rat runners" to understand how interesting and appealing rats can be. To the uninitiated they are smelly, nasty animals, but upon better acquaintance many people find, as Watson did, that rats' behavior can be fascinating. Until 1965 the rat was the standard animal in psychological research, especially on learning (Logan, 1999).

In the autumn of 1902, Watson suffered a serious psychological breakdown. His compulsive work habits and subsistence level of existence had finally taken their toll. He found himself overwhelmed by feelings of depression, worthlessness, and anxiety. Watson had been afraid of the dark all his life and now found it almost impossible to sleep. Often he would walk eight or ten miles through the streets of Chicago in the early morning hours. He was forced to leave the university to recuperate. Watson recovered within a month, but his breakdown was a frightening experience, and he resolved to "watch my step" (Watson, 1936, p. 274). He completed his dissertation, *Animal Education: An Experimental Study of the Psychical Development of the White Rat, Correlated with the Growth of Its Nervous System,* in 1903, and the newly independent Department of Psychology at the University of Chicago awarded him its first Ph.D. degree. At age 25, Watson was the youngest Ph.D. Chicago had graduated.

Watson hoped to bring his research to the attention of psychologists outside the University of Chicago and so arranged for the publication of his thesis. Publication by the University of Chicago Press cost him $350, at that time a large sum of money. He borrowed it from Donaldson. His willingness to go into debt to publish his thesis shows his self-confidence and belief in the importance of his research. Reviews of *Animal Education* in the psychological and general interest journals were favorable;[7] his experiments were described as meticulous and a valuable piece of work (Yerkes, 1904, p. 71). A review in *The Nation* called the work "a definite step in the advance of our knowledge of the correlation between cerebral structure and psychic function" (Staff, 1904, p. 435).

Watson was offered a number of academic positions, one with Donaldson in the department of neurology at the University of Chicago and one in psychology at the University of Cincinnati. Angell did not want Watson to leave either psychology or Chicago, so he offered Watson a position in psychology at the University of Chicago. Watson accepted Angell's offer. Had he decided to accept either Donaldson's offer or the position at Cincinnati, his career and possibly the history of psychology would have been very different. Watson's main teaching responsibility involved courses on experimental psychology. He taught them in a conventional manner, using Titchener's manuals (Chapter 5) and training the students to analyze the contents of their minds using introspection. However, he was never comfortable with Titchener's methods and was more at ease with animal than with human subjects, so he studied the behavior of rats in a laboratory in the basement of the psychology building. His research there did much to define his approach to psychology and, ironically, to undermine the *structuralist* approach he was teaching in the human laboratory one floor above. His rats could not talk; they could not introspect to describe the contents of their minds; what they could do was behave. As early as 1904, Watson began to think that psychology should concern itself with behavior rather than with the mind. He concluded that he could "find out by watching their behavior everything that the other students are finding out by using human observers" (Watson, 1936, p. 276). The reactions of his instructors were not encouraging. When he presented this approach to Angell, the rebuttal was forceful. "Man," Angell said, "is not a mere animal, but a thinking being." Angell never changed his conviction that the task of psychology is to study the functions of the mind. When Watson outlined his behaviorist position in 1913, Angell dismissed his views as "crazy" and "ignorant." Many years later, Angell described Watson's behaviorism as having "developed in such an extravagant manner" (Angell, 1936, p. 26).

Watson was an ingenious and skilled animal experimenter. His books and papers often included drawings and photographs of the apparatus he designed and built, some of which would find a use in a modern laboratory of comparative psychology. Watson began by studying the behavior of rats in mazes. Willard S. Small had introduced the maze to American psychology in 1899.

[7] In his biography of Watson, Cohen (1979) reports one important exception to the generally favorable reviews: "*Life* [magazine] seized on the story, spurred on by angry antivivisectionists. It pilloried Watson. He was criticized in print and caricatured in cartoons as a killer of baby rats. And all to what end? To see how animals could learn their way round a maze" (Cohen, 1979, p. 36). However, Dewsbury (1990, p. 320) reports that in a search of the relevant documents, he was unable to document the *Life* magazine incident and that Cohen was unable to provide relevant references.

Small believed the maze was an ideal apparatus for rats because it appealed to their "propensity for winding passages" (Small, 1900–1901, p. 208). His original apparatus was modeled on a garden maze King Henry VIII had built at Hampton Court Palace near London. Small placed a hungry rat at the starting point and gave it a piece of food when it reached the center of the maze. Originally Small had planned to use wild rats in his maze-learning experiments, but he experienced what he termed "considerable difficulties" with them and instead turned to laboratory rats. Small believed that "restrained anthropomorphism was wholesome," and so his descriptions of the rats' actions in the maze were often subjective and mentalistic. For example, Small reported that in many cases a rat's selection of the correct path "was accompanied by a flick of the tail and a general abandon that said 'I've struck the right trail' " (Small, 1900–1901, p. 213). Comparative psychologists, including Watson, criticized such descriptions, but Small deserves credit for introducing the maze to psychological research and thus giving psychologists an apparatus for studying animal learning.

Watson trained four rats to run through a miniature "Hampton Court maze" for food. Initially they took as long as 30 minutes, but after 30 training trials they required less than 10 seconds. Having spent some time wandering around the Hampton Court maze in a futile search for the exit, I find the performance of Watson's rats impressive. Watson asked the obvious question: "How do they do it?" First he trained rats to run the maze in daylight; once they had learned, he tested them in darkness. Their performance was unchanged. Other rats trained in the dark ran just as well in daylight. Next, Watson surgically blinded trained rats. After the operation there was a small falloff in performance, followed by rapid recovery. Watson concluded that vision was unimportant in the rats' maze behavior.

Next Watson investigated the importance of smell. Once rats had learned the maze, Watson washed and even boiled it to remove olfactory cues. The rats' performance was unchanged. Rats that were anosmic, that is, unable to smell, learned the maze quickly and with few errors. Deaf rats and those with their vibrissae cut off ran through the maze as well as intact animals did. One rat made blind, anosmic, deaf, and whiskerless was still able to run the maze. Watson reported that, "None of these subtractions of sensory data prevented normal reactions in animals which had already learned the maze, nor lengthened the time of learning" (Watson, 1907, p. 212). Only when the maze was rotated did the rats' performance change. Watson concluded that kinesthetic cues or muscle sensations were most important. With Harvey A. Carr (Chapter 11), he designed an ingenious apparatus to demonstrate the role such cues play (Carr & Watson, 1908). This maze could be lengthened or shortened without changing the sequence of turns. Rats trained in one maze were tested in the other. Animals trained in the longer maze often ran headlong into the walls at points where a choice was required; animals trained in the shorter maze would turn in to the sidewall before reaching the choice point. Similarly, rats trained in either a short or a long runway, when tested in the other one, would hesitate and stop halfway down the runway, apparently searching for food, or would run right past the food. Their muscles had "learned" the maze or runway. These were elegant experiments, and many years later Watson admitted that "thinking about them still gave a bit of a kick" (Watson, 1936, p. 276). Later experimenters trained rats to run or swim through mazes, pulled them through in trolleys, or carried cats through in their arms, but none of these ingenious experiments surpassed Watson and Carr's. Nevertheless, these experiments provoked an angry response from antivivisectionists.

The Antivivisectionist Response

Watson reported the results of his research in the *Psychological Review* and at the annual meeting of AAAS in New York City on December 27–29, 1906. Fearing a hostile press reaction, Watson had not wanted to present his results in New York, but Angell urged him to do so. Watson's fears were well-founded. On December 30, 1906, the *New York Times* ran a report of his research under the headline:

> Vivisection Described: Professor Watson Tells of Gradually
> Depriving a Rat of Its Senses to Test a Theory

In subsequent articles, Watson was labeled a torturer, and some writers raised the possibility of having him prosecuted for cruelty to animals (Dewsbury, 1990, p. 320). The antivivisectionist *Journal of Zoophily* pilloried Watson and asserted without any basis in fact that he planned similar experiments on monkeys and humans. One of their cartoons showed a fully conscious mad scientist, strapped to an operating table, surrounded by rats gleefully drilling holes to remove "hot air" from his brain and preparing to saw off his ears, legs, and arms (originally published in 1907, reproduced in Dewsbury, 1990, p. 321). The president of the University of Chicago was under pressure to end such research at his institution. He referred the matter to the chair of the department of psychology. Angell defended Watson and pointed out that the operations had been done under anesthesia and asepsis, that the animals had all recovered, and that they all had prodigious appetites and played happily with their companions (Angell, 1907, p. 3). Watson's encounter with antivivisectionists showed the intensity of reactions to animal research, in particular to work that is intrusive. Such reactions have a long history and continue to this day (Dewsbury, 1990).

Watson's Field Studies of Animal Behavior

While at the University of Chicago, Watson began field studies of noddy and sooty terns on the Dry Tortugas Islands seventy-five miles west of Key West, Florida, in the Gulf of Mexico (Todd & Morris, 1986). He spent the summers of 1907, 1910, and 1913 there, making naturalistic observations of the gulls' behavior, especially the exchange of signals that occurs when a foraging parent bird returns to the nest to feed the young. The young gulls pecked the parent's bill, and the adult would then regurgitate food for them to eat. Watson also studied nest building, egg incubation, territorial defense, and migration. He tested egg recognition by painting some of the eggs or substituting fake eggs. He found that birds would accept both painted and fake eggs and that placing an egg in the empty nest of a noddy tern would elicit a full range of nesting behavior in the bird. To study their homing behavior, Watson sent birds away from the island in boats in all directions. He found that they could return from locations many miles away. He also noted that three-day-old sooty terns would run toward him and would answer his "peeps." The *Chicago Sun Times* reported Watson's research in an article headlined (Dewsbury, 1990, p. 320):

Unclad U. of C. Man Hears Birds Talking

Watson himself commented: "The birds have formed a great attachment for me. They will follow me all around the room. It is becoming more and more difficult to keep them in any box" (Watson, 1908, p. 240).

Watson's observations anticipated Konrad Lorenz's later reports of what he termed *imprinting* (Lorenz, 1935). In general, Watson's studies are best described as ethological studies of instinctive behavior. This description is somewhat ironic, since to contemporary ethologists such as Lorenz and Niko Tinbergen, Watson often seemed an archenvironmentalist, and he and other comparative psychologists have been criticized as being "ratomorphic," that is, unfamiliar with any animal other than the laboratory rat. In 1950, Lorenz asserted: "If J. B. Watson had only once reared a young bird in isolation, he would never have asserted that all complicated behavior patterns were conditioned" (Lorenz, 1950, p. 233). Clearly, no one could have applied such a criticism to Watson early in his career. At the University of Chicago, Watson also did laboratory and field experiments with monkeys, chickens, dogs, cats, frogs, and fish. His was truly a comparative psychology.

Watson at Johns Hopkins University

Watson's years at Chicago were happy ones in both his personal and his professional life. In 1904, he married a former student, Mary Ickes, the daughter of former Secretary of the Interior Harold Ickes. The Watsons had two children, Mary and John. In a letter, Watson wrote of his son John: "A baby is more fun to the square inch than all the rats and frogs in creation" (Watson, in Cohen, 1979, p. 38). Professionally, Watson had established a laboratory of comparative psychology with an interest in animal research that continued under Carr after he left Chicago. In 1907, James Mark Baldwin (1861–1934), the head of the department of philosophy and psychology at Johns Hopkins University, offered Watson an assistant professorship at his university. Both the salary of $2,500 a year and the rank were higher than what Watson had at Chicago. Angell countered by offering Watson a position as an assistant professor elect. The salary was lower, but Watson decided to stay at Chicago. The next year Baldwin made him an even better offer—the chair of psychology at Johns Hopkins at a salary of $3,500 a year. Angell did not match this offer, and Watson could not refuse.[8] He left reluctantly:

[8] Watson may have inflated the salary offer from Hopkins. A copy of a telegram dated March 2, 1908, in the Johns Hopkins Eisenhower Library archives sent from Watson to Baldwin states that Watson accepts the Hopkins position at a salary of $3,000 (Kornfeld, 1994).

> I hated to leave the University of Chicago laboratory and Mr. Angell. I am sure I would not have gone had they offered me even an associate professorship. I had several researches going. I had wired the lab with my own hands, built the partitions, animal yards, and much apparatus. (Watson, 1936, p. 275)

Watson was 29 years old and had traveled a long way in a very short time. Twelve years later, his academic career was to come to a sudden and dramatic end.

A major scandal involving Baldwin erupted at Johns Hopkins shortly after Watson's arrival:

> On March 6, 1909, he [Baldwin] was nominated by the mayor of Baltimore to the School Board. By the 11th he had been asked to resign from the University and had left the city. . . . In the summer of 1908, Baldwin had been caught in a police raid on a "colored house of prostitution." He gave a false name to the police and the charge was eventually dropped; although [Ira] Remsen [the president of Johns Hopkins] had information on the matter, he made no effort to pursue it. Only when the School Board nomination was announced did those who knew the secret feel called upon to act. (Pauly, 1979, p. 38)

President Remsen demanded Baldwin's resignation, and Baldwin left for Mexico. A cryptic note in the *Psychological Bulletin* of 1909 read: "Professor Baldwin has resigned his position in the Johns Hopkins University. He is advised to give his voice a prolonged rest from continued lecturing" (p. 256).

Previously Baldwin had been chosen to preside at the forthcoming International Congress of Psychology, but his nomination was withdrawn. He lived the rest of his life in Mexico and Paris, an outcast from American psychology.[9] Baldwin's departure affected Watson in a number of ways. First, he lost Baldwin's support and guidance. Watson now had no departmental superior and so was free to do what he wished and to steer the department of psychology in whatever direction he chose. Second, he inherited from Baldwin the editorship of the *Psychological Review.* He was now free to publish his views in the journal he edited. Third, Watson had seen firsthand the disastrous career consequences of behavior the Johns Hopkins administration considered immoral or unethical. This lesson he did not learn, and ten years later he to would be forced to resign from the university on moral grounds.

In his early years at Johns Hopkins, Watson began to think more and more about the nature of psychology and his earlier views that it should become the science of behavior. Now there was no Angell to discuss such ideas with and no Baldwin to criticize them. Watson became convinced that describing behavior without reference to consciousness was the only way in which psychology could become a true science. In 1910, *Harper's Magazine* paid Watson $75 for an article called "The New Science of Animal Behavior." In 1913, Cattell invited Watson to give a series of lectures at Columbia University. The lectures

[9] Before his exile, Baldwin was a man of considerable status and power. His genetic psychology was well-regarded; in Cattell's (1903) survey of prominent psychologists, he ranked as the fifth most important contributor to psychological research, ahead of such notable psychologists as Dewey and Titchener; his position at Johns Hopkins gave him great influence (Broughton, 1981).

attracted large audiences and were well-received. That same year, Watson published in the *Psychological Review* a detailed outline of his views—his behaviorist manifesto.[10]

Watson's Behaviorist Manifesto[11]

The forceful opening paragraph of "Psychology as the Behaviorist Views It" left no doubt as to Watson's intent:

> Psychology as the behaviorist views it is a purely objective experimental branch of natural science. Its theoretical goal is the prediction and control of behavior. Introspection forms no essential part of its methods, nor is the scientific value of its data dependent upon the readiness with which they lend themselves to interpretation in terms of consciousness. The behaviorist, in his efforts to get a unitary scheme of animal response, recognizes no dividing line between man and brute. The behavior of man, with all of its refinement and complexity, forms only a part of the behaviorist's total scheme of investigation. (Watson, 1913, p. 158)

The challenge this *behaviorist manifesto* laid out was explicit. Watson intended to force psychologists to choose between his behaviorism and older conceptions of psychology. There could be no middle ground. Prior to Wundt, argued Watson, there had been *no* psychology; after Wundt, there had been only confusion, controversy, and conflict. Watson could lead psychology out of the darkness.

In "Psychology as the Behaviorist Views It," Watson developed the following points. First, he stated that psychology had failed signally during the fifty-odd years of its existence to develop as an undisputed natural science. This failure, Watson asserted, had been caused by concentration on either the structure or the functions of consciousness. These two elements had proved equally unproductive, for no two psychologists could agree on a definition of consciousness or specify the methods to be used in its study. *Consciousness,* for Watson, was neither a definable term nor a usable concept. In the approaches of both the structuralists and the functionalists Watson found only confusion, and so he rejected both. His new behaviorist psychology would abandon the "delusion" that consciousness is a fit subject for study. As the wags put it, "Psychology, first having lost its soul to Darwin, now lost its mind to Watson." A second argument Watson advanced was that since consciousness could not be studied, there was no need for introspection, a method Watson believed had hindered the development of psychology as a science. Introspection led only to endless argument and debate over such "pseudoissues" as the nature of attention and apprehension, sensory and motor reaction times, imageless thought, and stimulus error. Only appeals to an authority such as Titchener could resolve such disputes, and Watson was not one to accept the views of any such

[10] *manifesto,* n. A public declaration of intentions, opinions, objectives, or motives (RHDEL, p. 872).
[11] Reprinted in Watson, J. B. 1994. Psychology as the behaviorist views it. *Psychological Review, 101,* 248–253.

authority. Watson believed passionately that introspection was a faulty and defective method. All too often introspectionists had been criticized as poorly trained or incompetent if their reports did not agree with those of their teachers. Watson argued instead that the method itself was defective. Accordingly, psychologists must replace introspection with objective, experimental methods comparable to those used in other sciences. If not, Watson predicted, psychologists 200 years in the future would still be engaged in the same futile disputes and arguments.

A third point Watson made was that psychology was no longer the science of the *mind* and had no further use for introspection. What, then, were psychologists to do? Watson's answer was direct and simple: "They are to study behavior" (Watson, 1913, p. 159). Psychology must become the science of behavior, with its goals to observe, predict, and control behavior. It must study both animal and human behavior, for Watson regarded animal behavior as directly relevant to an understanding of humans. He saw no dividing line between human behavior and that of other animals. A rat running a maze, a gull building a nest, a child playing, a teacher in a class, a businessperson selling a product, and a politician making a speech are all behaving, and as such provide grist for the behaviorist's mill. Having outlined his position, Watson ended his paper with the following call to the standard of behaviorism:

> What we need to do is to start work upon psychology, making behavior, not consciousness, the objective point of our attack. Certainly there are enough problems in the control of behavior to keep us all working many lifetimes without ever allowing us time to think of consciousness as such. Once launched in the undertaking, we will find ourselves in a short time as far divorced from an introspective psychology as the psychology of the present time is divorced from faculty psychology. (Watson, 1913, p. 176)

Action and Reaction

While Watson's behaviorism was radical, it was not without precedent. Other psychologists shared his dissatisfaction with the "old gods" of introspection, consciousness, sensation, and image. Among them was Watson's colleague at Hopkins, Knight Dunlap, who had published "The Case Against Introspection" in the *Psychological Review* one year before Watson's behaviorist manifesto (Dunlap, 1912) (Chapter 5). Dunlap's critique was eclipsed by Watson's rising star. In his autobiography, Dunlap speculated that perhaps he had been too cautious in his critique and so had not had Watson's impact (Dunlap, 1932).[12] Today Dunlap is little known to most psychologists (Kornfeld, 1991).

A growing cadre of psychologists, tired of the old disputes that so often seemed lifeless and full of shadow, answered Watson's call to behaviorism. His approach seemed attractive, vital, dynamic, full of promise, and well-suited to life in America in the first decades of a new century. While Boring's claim that

[12] Dunlap's personal reaction to Watson is reflected in the advice he supposedly gave his two daughters: that when Watson entered the room, they should immediately leave (Wickens, 1980)!

"for a while in the 1920s, it seemed as if all America had gone behaviorist" (Boring, 1957, p. 645) is an exaggeration, Watson's behaviorism did have wide appeal. His definition of psychology as "the science of behavior" had been proposed by William McDougall (Chapter 7) in 1905 and by Walter B. Pillsbury in 1911, but their proposals had little impact. Watson had an aggressive personality and style, and he wanted to create a revolution in psychology. He was a radical with a clear, simple, unambiguous proposal for change. Strong actions often provoke strong reactions, and reactions to Watson were soon forthcoming. One came from a predictable source—Edward Titchener.

Titchener defended introspective studies of consciousness and pointed out that psychology was still a young science that had indeed made progress. Watson, Titchener contended, was too impatient. His behaviorism was "ridiculously crude" and not part of psychology since it did not study the mind; rather, it was a technology used to control and manipulate behavior. Titchener wrote to Yerkes: "Watson is the kind of man, I think, who should never trust himself to write on general questions, but should stick to his concrete work. He has no historical knowledge, and no power of continuous thinking in the realm of concepts" (Titchener, in Karier, 1986, p. 129). Despite such criticism, Watson remained on cordial terms with Titchener throughout his life (Larson & Sullivan, 1965). Titchener's criticism of Watson might actually have stimulated support for the behaviorist position, since no psychologist likes to be told what he or she can and cannot do. Other psychologists, including Cattell, McDougall, Woodworth, Thorndike, Münsterberg, and Angell, attacked Watson's proposals as too extreme, but Watson remained true to his behaviorist position.

Behaviorism in Action

Having stated his position, Watson had to show that behaviorism was indeed workable, that it was possible to have a science of behavior without recourse to consciousness and the mind. During the next ten years, Watson worked assiduously to make good his claim.

In 1909, Robert Yerkes and Sergius Morgulis published a paper entitled "The Method of Pawlow in Animal Psychology" (original spelling of *Pavlov*) in the *Psychological Bulletin* (Yerkes & Morgulis, 1909). The article described Pavlov's experiments on conditioning glandular responses in dogs. This paper introduced Pavlov's research to American psychologists, describing in detail his methods and the laws of conditioned reflexes. That same year, Yerkes moved to the Johns Hopkins Medical School, where he continued his experiments on conditioned glandular responses in dogs. He and Watson became good friends. At first, Watson believed that Pavlov's conditioning method had limited applicability. In *Behavior: An Introduction to Comparative Psychology* (1914), Watson gave a detailed description of "Pawlow's [sic] salivary secretion method" but questioned its general usefulness. Watson pointed out that while dogs adapted well to this type of experiment, the method could not be used with birds, fish, reptiles, or primates. Later, under pressure of events and circumstances, Watson was to change his behavior, if not his mind.

Another man Watson met at Johns Hopkins also influenced his career. Karl S. Lashley (1890–1958) enrolled as a graduate student in 1912 and took a Ph.D. in zoology with a minor in psychology under Watson. Lashley and Watson worked on a wide range of comparative behaviors: homing in pigeons, imitation in parrots, color vision in hens, the effects of strychnine and caffeine on learning in rats, handedness in monkeys, and skill acquisition in humans. However, from Watson's point of view, their most important research concerned the nature of thought. In his 1913 paper, Watson had considered how a behaviorist could study thought and thinking. Since mental events are not directly observable, how can we study them? Watson's answer was characteristically direct and simple. Thinking is nothing more than subvocal speech, and this activity would be associated with "faint contractions of the musculature involved in speech" (Watson, 1913, p. 174). If these "faint contractions" of the speech muscle systems could be observed and recorded, thought would be accessible to the behaviorist. Watson believed that the relationship between such recordings and thought would be similar to that between a phonograph record and a symphony concert. Making such recordings would be a triumph for behaviorism and would deal a telling blow to introspective approaches to thought.

In 1915, Watson was elected president of the APA. In his presidential address, he planned to restate his views on the nature of thought and show recordings of subtle movements of the tongue and larynx associated with thinking. Watson had always been a technically adept experimenter and was confident that he could make such recordings. He and Lashley spent the summer of 1915 trying to make them, but their efforts were unsuccessful. They continued to try well into the autumn months, but without success. To add to Watson's unhappy state, his wife was gravely ill, and during these months he nursed her back to health. No matter how desperately Watson and Lashley tried to record the "faint contractions," they failed. Just two weeks before his scheduled address Watson, at Lashley's suggestion, finally abandoned the attempt and changed the title of the address to "The Place of the Conditioned Reflex in Psychology" (Watson, 1916). Watson told his audience that having rejected introspection, he felt a responsibility to suggest a new method for psychology. Without mentioning subvocal speech or his unsuccessful attempts to record the faint contractions he had believed accompany thinking, Watson described the conditioned reflex as an objective, experimental technique that held great promise. He described the conditioning experiments he and Lashley had done with humans, dogs, and owls. Watson showed photographs of a dog and an owl resting comfortably in the conditioning apparatus. He predicted that the conditioned reflex method would take a "very important place" among the methods of psychology and would prove to be a technique of "wide generality." In conclusion, Watson admitted to "a bias in favor of this method."

From that time on, the conditioned reflex held a central position in Watson's behaviorism. It had been a close call, but the resourceful Watson had overcome another of "life's little difficulties." In 1920, Watson returned to the question, "Is thinking merely the action of language mechanisms?" (Watson, 1920). In characteristic fashion, he firmly asserted:

Before attempting to define further in this Symposium the behaviorist's position on thinking, it would seem best to discuss for a moment some of the statements the behaviorist has already made. In advance of any argument, I think we can say that he never really held the view that thinking is merely the action of language mechanisms. Possibly my own loose way of writing may have lent color to such views." (Watson, 1920, p. 87)

Watson and World War I

When the United States entered World War I in 1917, Watson tried to enlist as a line officer but was turned down because of poor eyesight. Instead, the committee on Classification of Personnel in the Army gave him the task of organizing and running the boards that screened applicants for pilot training. The military authorities were especially interested in rating would-be aviators' endurance under conditions of reduced oxygen similar to those that might be encountered in flight. Watson devised a number of perceptual and motor tests that were given under conditions of progressive asphyxiation. However, in his opinion they proved nothing and were worthless as selection devices. He also questioned the value of the rotation test, a great favorite of the military. This test, they believed, could measure the critical senses of equilibrium and balance. However, circus acrobats, trapeze artists, and successful pilots scored below the selection criterion established for would-be aviators. Watson was convinced that the test was invalid and wrote a report expressing his opinion. He was nearly court-martialed for doing so, and thereafter his military record carried the notation that "he not be allowed to serve his country in his scientific capacity but be sent to the line" (Cohen, 1979, p. 110). Fortunately, the war ended before this transfer could be made, and Watson ended what he termed his "Army nightmare," returning to Johns Hopkins.

Watson's Research with Children

In 1916, Watson began research with children at the Henry Phipps Psychiatric Clinic in Baltimore. Adolf Meyer (1866–1950), the first professor of psychiatry at Johns Hopkins and the founding director of the Phipps Clinic, advocated a psychobiological approach to mental illness. He was sympathetic to Watson's behaviorism and invited him to create a research laboratory for the study of child development. Watson had long been interested in the behavior of children. At Phipps, he began a series of studies of newborn infants that continued after the war was over. At the time, forty to fifty babies were born at Johns Hopkins University Hospital each month. Watson and his students observed the neonates while they were in the hospital and followed a small number after they had gone home. In all, Watson studied more than 500 infants.

First, the researchers observed an infant's reflex and emotional reactions. The newborn infant seemed to have a number of reflexes: sneezing, hiccuping, yawning, coughing, grasping, swallowing, and sucking. In addition to these reflex responses, Watson believed that three main classes of emotional response were distinguishable in the human neonate: fear, rage, and love. Each of these basic emotions was elicited by a restricted set of stimuli: fear by a sudden loud noise or loss of support; rage by restraint that hampered the infant's movements; love by stroking and fondling. Each emotion was characterized by a specific set of responses. These neonatal emotions matched Watson's model of behavior: specific stimuli elicited specific responses in a reliable and predictable manner.

Watson also found that many stimuli that had often been said to elicit "innate" fear reactions were ineffective. His infants showed no fear of the dark or fire and no fear of animals such as snakes, rats, or dogs. In fact, these stimuli often elicited curiosity and friendly investigation. Why, then, do so many older children fear the dark, fire, snakes, rats, and dogs? Because, Watson answered, they have learned to do so. In a 1917 paper, Watson first suggested that conditioning could transfer the three basic emotional reactions to a range of stimuli (Watson & Morgan, 1917). In other words, fears can be learned. Watson himself had a lifelong fear of the dark, a fear that at times was so strong that he could sleep only in a room with a light. He traced this fear to a nurse in Greenville who told him that the devil goes around at night looking for naughty little boys. Watson himself thus provided a dramatic confirmation of the truth of John Locke's prediction "Let but a foolish nurse . . ." (Chapter 2). In the winter of 1919–1920, Watson made a direct test to see whether a fear could be conditioned in a human infant. This was his experiment with "Albert B." or "Little Albert," one of the best known experiments in the history of psychology.[13]

Watson and Albert B.

Watson and his coworker Rosalie Rayner, a student from Vassar, selected Albert B. because of his stolid temperament. He was the 11-month-old son of one of the hospital's wet nurses, a healthy, happy boy who had lived all his life in the hospital and so was unafraid of the testing situation. Albert had few fears and reacted with friendly curiosity to the sight of a rat, a dog, a rabbit, a monkey, and even a fire. However, he did show an intense fear reaction when a metal bar was struck behind his head. Watson and Rayner set out to condition a fear of white rats in Albert. They showed him a white rat, and as soon as he reached out for it, they struck an iron bar. After only seven pairings of the rat and the loud noise made when the bar was struck, Albert cried and crawled

[13] Watson and Rayner's experiment has sometimes been described as the first successful demonstration of conditioning in a human infant. That description is incorrect. Windholz and Lamal (1986) reviewed three earlier attempts. In 1907, a German, Heinrich Bogen, conducted classical conditioning experiments with children. But the most impressive experiments were those of the Russian N. I. Krasnogorskii. In 1907 and 1908 at the pediatric hospital in St. Petersburg, Krasnogorskii used Pavlov's methods with young children to demonstrate acquisition and extinction of a conditioned response, generalization, discrimination, and trace conditioning. In 1908, an American, Florence Mateer, used conditioning procedures with fifty children aged 12 months to 7 years. Despite their priority and importance, none of these reports had nearly the impact of Watson's and Rayner's.

away when he saw the rat, even without the noise. Watson and Rayner had conditioned a strong fear in a human infant.

Five days later, Albert was shown the rat, a set of wooden blocks, a rabbit, a short-haired dog, a sealskin coat, a package of white cotton balls, the heads of Watson and his assistants, and a bearded Santa Claus mask. He showed a strong fear response to the rat, the rabbit, the dog, the cotton, and the sealskin coat. Albert's response to Watson's head and to the cotton balls was still negative, though milder; but he played happily with the blocks. The conditioned fear had generalized to a variety of white, furry objects having some similarity to the rat. Five days later, Albert showed such a slight reaction to the rat that Watson and Rayner decided to "freshen the reaction" by presenting it with the loud noise once again. In addition, they paired the rabbit and the dog with the noise. Thirty-one days later, Albert was tested for the last time and was found to show a fear of the Santa Claus mask, the sealskin coat, the rat, the rabbit, and the dog. At that time Albert's mother removed him from the hospital, and he was never tested again.

One of the most frequently cited experiments in psychology textbooks, the study of Albert B. has also been the subject of much distortion and misrepresentation.[14] First, while the experiment is usually presented as an illustration of classical or Pavlovian conditioning of fear, from Watson's description, it clearly had a strong punishment component. Whenever Albert reached for the rat, a loud noise followed—a typical punishment procedure. Second, after Watson and Rayner's report, a number of researchers attempted to replicate their results (English, 1929; Valentine, 1930; Bregman, 1934). Although these investigators found no evidence that fears could be conditioned in the way Watson and Rayner had described, their results are seldom mentioned in psychology texts. Third, Ben Harris (1979) pointed out that no detail of the original experiment has escaped misrepresentation and distortion: Albert's age and the objects and intensity of his fear have been changed; the range of generalization has been extended by imaginative writers to include all furry animals, a fur pelt, a man's beard, a cat, a puppy, the fur neckpiece Albert's mother supposedly wore, and even a teddy bear. At times the story has been given a happy ending in which Albert's fear is removed or deconditioned. Some imaginative writers even provide detailed descriptions of the reconditioning procedures—procedures that in fact never took place (Gilovich, 1991, p. 90). In addition, reports never mention a significant piece of information: Watson and Rayner knew that Albert's mother planned to remove him from the hospital a number of weeks before he left, and yet they did nothing to help him overcome his fear. Textbook accounts of this experiment have come to be based more on myth than on reality.

Watson and Rayner's experiment with Albert quickly became widely known. Watson regarded their results as a conclusive demonstration that fears

[14] Watson and Rayner's (1920) *Journal of Experimental Psychology* paper "Conditioned Emotional Reactions" was reprinted in 2000 in the *American Psychologist, 55,* 313–317.

can be conditioned and went on to argue that most fears are acquired in this manner. The graphic descriptions of Albert's behavior ensured wide publicity:

> The instant the rat was shown, the baby began to cry. Almost instantly he turned sharply to the left, fell over on his left side, raised himself on all fours, and began to crawl away so rapidly that he was caught with difficulty before reaching the edge of the table. (Watson & Rayner, 1920, p. 3)

Watson and Rayner used their results to attack Freud and to ridicule dream analysis (Rilling, 2000), as in this tasteless parody in the paper's conclusion:

> The Freudians twenty years from now, unless their hypotheses change, when they come to analyze Albert's fear of a sealskin coat—assuming that he comes to analysis at that age—will probably tease from him the recital of a dream which upon their analysis will show that Albert at 3 years of age attempted to play with the pubic hair of the mother and was scolded violently for it. (Watson & Rayner, 1920, p. 14)

Later, conditioning procedures like Watson's and Rayner's were portrayed in sensational terms in Aldous Huxley's 1932 novel *Brave New World,* George Orwell's *Animal Farm* (1946) and *1984* (1949), and Anthony Burgess's *A Clockwork Orange* (1963).

Watson's Separation from Psychology

By 1920, Watson's career was going well. His experiment with Little Albert had confirmed his view that fears are acquired through conditioning. In 1919 he published a major book, *Psychology from the Standpoint of a Behaviorist*. Concerned that Watson might move to another university, the president of Johns Hopkins gave him a generous salary increase. Many younger psychologists found his behaviorism attractive. One of them, Mary Cover Jones, recalled:

> As graduate students at Columbia University, my husband Harold E. Jones and myself, and other members of our student group, were among those to whom Watson "sold" behaviorism. I can still remember the excitement with which we greeted *Psychology from the Standpoint of a Behaviorist.* It shook the foundations of traditional European-bred psychology, and we welcomed it. That was in 1919; it pointed the way from an armchair psychology to action and reform and was therefore hailed as a panacea. (Jones, 1974, p. 582)

Despite this success, 1920 also brought the end of Watson's academic career. The details of this sad and shattering episode read more like the script of a modern soap opera than the biography of a scientist (Cohen, 1979).

Throughout his marriage, Watson had affairs with many women,[15] but eventually he fell in love with his research assistant, Rosalie Rayner. Watson made his feelings known and wrote many passionate letters to Rayner. His

[15] In a paper delivered at the 1988 APA convention, John Burnham, a respected historian of psychology and the editor of the *Journal of the History of the Behavioral Sciences,* reviewed Watson's colorful life and concluded that in his sexual life Watson "may have been one of the great lovers of all time."

wife, Mary Ickes Watson, obtained these letters by feigning illness while visiting Rayner's parents, asking for a few minutes to lie down, and using the time during which she was alone to search Rayner's bedroom. Despite this desperate ruse, her motive was honorable; Mary was trying to save her marriage, and she expected that once he knew she possessed the letters "she would be able to persuade Watson to come back" (Cohen, 1979, p. 149). Her mistake came when she showed the letters to her brother, John Ickes, a mercenary character who then demanded money from Watson and from Rayner's rich, socially and politically prominent Baltimore family. When they refused, the letters mysteriously fell into the hands of President Goodnow of Johns Hopkins. With the support of the senior faculty, including Adolf Meyer, Goodnow concluded that Watson had disgraced himself, Johns Hopkins, and science and demanded his resignation. Watson dutifully complied. In a letter to Meyer, Watson insisted that "both psychology and the university could do without me" and stated confidently that he would be able to find a position "that will not be as bad as raising chickens or cabbages" (Watson, 1920, in Buckley, 1982, p. 211).

Unfortunately, the sensational publicity surrounding the subsequent divorce made it impossible for Watson to find another academic position. The newspapers had a field day reporting the court testimony in lurid detail and portraying Watson as the master behaviorist who had seduced his beautiful research assistant and betrayed his wife and children. The trial judge gave Watson a severe tongue-lashing, branding him, among other things, "an expert on misbehavior." The divorce was granted on December 24, 1921, and Watson married Rayner ten days later. Many of Watson's friends and colleagues, with Yerkes and—perhaps surprisingly—Titchener as notable exceptions, abandoned him. In a letter to Yerkes, Titchener wrote:

> I am terribly sorry for the Watson children, just as I am sorry for Watson himself; he will have to disappear for five or ten years I am afraid, if he even wants indeed to return to psychology. What makes me indignant, is that A. Meyer and the Clinic in general couldn't have used their arts to keep W. straight. They are so blamed keen on theory—in which they are, after all, only logical infants—that they forget that the business of the psychiatrist is to prevent and cure. A little decent advice (for W. is intrinsically a very decent and eminently likable person) would have prevented the family tragedy. And it is the children who suffer most. (Titchener, in Leys & Evans, 1990, p. 105)

Watson resolved to go into commercial work. In *Psychology from the Standpoint of a Behaviorist,* Watson had claimed that the behaviorist's ability to predict and control behavior would allow important contributions to business and industry. Now he was about to test this claim. His friend William I. Thomas, a sociologist who had been dismissed from the University of Chicago amid charges of sexual impropriety, introduced him to Stanley Resor, the president of the J. Walter Thompson advertising agency in New York City. Resor's aim was to make his agency a "university of advertising," so Watson was a good catch. Resor offered Watson the grand salary of $10,000 a year, but insisted that he learn the advertising business from the ground up by working in the field.

Watson's first assignment was to survey the rubber boot market along the Mississippi River. He went from town to town, asking people which brand of rubber boots they wore and why. Next he surveyed grocers in large cities, trying to persuade them to stock and sell Yuban coffee. Watson referred to this thankless task as "Yubanning" and admitted that he had been "shown the door quite frequently" (Watson, 1936, p. 279). He was determined to succeed, but trudging around doing surveys must have been depressing work. Resor also arranged for Watson to serve a two-month stint as a counter clerk at Macy's so that he could observe consumer behavior firsthand. Later, some academic psychologists criticized Watson for selling out to commerce. One wonders how many of his critics, finding themselves in his situation, would have had the fortitude to do as well as he did.

Slowly Watson came to understand advertising. He discovered that: "The consumer is to the manufacturer, the department stores, and the advertising agencies, what the green frog is to the physiologist" (Buckley, 1982, p. 212). Behaviorism seemed ideally suited to predicting and controlling consumers' behavior. Earlier Watson had "sold" behaviorism to psychologists; now he would use behaviorism to sell products. Watson became an innovative and creative advertising executive. He was the first person to use careful demographic surveys of target populations of consumers and to offer free samples in exchange for filling out questionnaires. In his advertising campaigns, Watson stressed style over substance and insisted that the function of advertising was to make people reasonably dissatisfied with what they already owned. He made large-scale use of testimonials and appeals to authority: Queen Victoria Eugenia of Spain and Queen Marie of Romania[16] endorsed Pond's Cold and Vanishing Cream for him. Watson also tried to manipulate the consumer's motives and emotions. In a campaign for Johnson & Johnson Baby Powder aimed at first-time mothers, Watson stressed the purity and cleanliness of the product and the dangers of dirt and disease. Watson also directed a successful advertising campaign that changed the image of life insurance salesmen from "harbingers of death" to "bearers of life." In advertisements for the first underarm deodorants, Watson stressed personal hygiene. At times, his manipulations of consumers' emotions were blatant. In an advertisement for the Scott Paper Company, Watson featured a photograph of a surgical team at work with the caption "And the trouble began with harsh toilet tissue." In one carefully controlled experiment, Watson found that 90 percent of smokers were unable to discriminate one brand of cigarettes from another, so he used advertising slogans such as "I'd walk a mile for a Camel" to stimulate brand loyalty in consumers. To increase the sales of Maxwell House coffee, Watson popularized the coffee break and encouraged its adoption with the slogan, "Give yourself a coffee break, and get what coffee gives you."[17] By 1952, 80 percent of companies

[16] The actress Mariette Hartley, Watson's granddaughter, recalled that Queen Marie sent her grandson to Watson to be reconditioned with "kingly qualities" (Hartley, 1991, p. 17).
[17] In 1902 the Barcolo Manufacturing Company in Buffalo, NY, started giving its employees mid-morning and mid-afternoon coffee breaks (Stamberg, 2002). This innovation was not adopted by other companies.

polled had instituted coffee breaks; Watson's innovation had become a feature of American life (Pendergrast, 2000). Watson was also one of the first advertisers to use radio effectively.

Obviously, Watson was a successful advertising executive. He was paid a very high salary—close to $70,000 in 1930—and enjoyed the executive perquisites, yet he always missed psychology. In a poignant passage of his autobiography, Watson wrote of his advertising years: "I began to learn that it can be just as thrilling to watch the growth of a sales curve of a new product as to watch the learning curve of animals and men" (Watson, 1936, p. 280). Perhaps so, but at least until around 1930, it seems that had Watson been able to trade watching sales curves for cold cream, coffee, and underarm deodorants for the opportunity to watch learning curves in the laboratory of a major university, he would willingly have done so. No such opportunity was offered him.

During the 1920s and 1930s, Watson published books and articles on psychology for the general public. He was also in great demand as a lecturer, both in person and on radio. Watson became "the first pop psychologist to the rapidly expanding middle class, assuming the role once held by the minister in a more rurally based society" (Buckley, 1982, p. 217). Watson also wanted to carry on the research he had begun with children at Johns Hopkins. In 1923, he obtained a grant from the Laura Spellman Foundation for this research. With the assistance of Mary Cover Jones and Harold Jones, he was able to study seventy children ranging in age from 3 months to 7 years. One of the most important investigations concerned overcoming children's fears, research Mary Cover Jones had initiated (Mussen & Eichorn, 1988, p. 818). After hearing Watson lecture on Little Albert and the development of fears through conditioning, Mary Cover Jones discussed with Watson the idea of eliminating "home-grown" fears using conditioning methods. Watson encouraged her, and together they worked on overcoming the fears of Peter B.

Overcoming Fears: The Case of Peter

Watson and Jones studied a number of possible ways of overcoming fears. It was usually ineffective to simply allow long periods during which a child did not encounter the feared object. One little girl went more than two months without seeing a feared rabbit, but burst into tears as soon as she saw the animal again. In a verbal organization method, children were encouraged to talk about their fears, but this method also proved ineffective. In a social imitation method, a child who feared a particular object met another child who had no fear of that object. Seeing this child play with the feared object, however, did not overcome the first child's fear. The most effective method for overcoming fear was direct conditioning. Watson, using Mary Cover Jones's case notes (Jones, 1924a, 1924b), described Peter as follows:

> Peter was an active, eager child of approximately 3 years of age. The child was well-adjusted to ordinary life situations except for his fear organization. He was afraid of white rats, rabbits, fur coats, feathers, cotton wool, frogs, fish, and mechanical toys. From the description of his fears, you might well think that Peter was merely Albert B. grown up. Only you must remember that

> Peter's fears were "home-grown," not experimentally produced as were Albert's. Peter's fears, though, were much more pronounced. (Watson, 1928a, p. 62)

When a rat was brought into the room, Peter screamed and fell on his back. Then Jones introduced Barbara, a child who handled the rat without fear, but Peter refused to leave his chair. He seemed even more afraid of a rabbit. On seven treatment days, Peter played with three children who showed no fear of a rabbit. Peter progressed from "great fear" to "tranquil indifference" and with the other children could even pat the rabbit's back. His treatment was then interrupted for two months as he was hospitalized with scarlet fever. As Peter left the hospital with a nurse, a large dog jumped up on them, frightening both Peter and the nurse. Jones described confronting a large dog with an adult who showed fear as a terrifying situation "against which our training could not have fortified him" (Jones, 1924a, p. 312). It was at this point that Jones began "direct conditioning."

Peter sat in a high chair; just as he was about to begin his lunch of milk and crackers or a snack of food that he liked and candy, a caged rabbit was brought into the room and put down about twelve feet away from him. Care was taken not to disturb Peter's eating. The next day the rabbit was brought a little closer, and on succeeding days the same routine was followed, with care taken never to arouse Peter's fear. Finally, the uncaged rabbit could be placed on his table, and Peter would eat with one hand while patting the rabbit with the other. His fears of cotton wool, a fur coat, and feathers were also found to have been eliminated, and his reactions to a rat and other animals greatly improved. Peter went home to a difficult environment, but Watson and Jones kept in touch with him and reported that he continued to be fond of rabbits and would often approach and play with them.

Peter's case has often been cited as a classic in the development of behavioral techniques to treat fears or phobias (Eysenck, 1960). The similarity of Watson and Jones's technique to that suggested by John Locke (Chapter 2) for overcoming a "vain terror of frogs" is worth noting. Such deconditioning or desensitization procedures are widely used today in behavioral treatments of fears and phobias (Wolpe, 1958, 1973). However, other aspects of Peter's treatment and the interpretation of his case have been neglected (Kornfeld, 1989). Often, writers neglect to even mention the first seven treatment periods of social imitation. These sessions clearly resemble social learning through modeling or imitation (Bandura & Walters, 1963). Jones also recognized the role imitation played in strengthening Peter's fear when he and the frightened nurse confronted the dog.

Watson's Views on Nature versus Nurture

The fundamentals of Watson's behaviorist position changed little over the years, but he did modify some of his views. His changing conception of the relative roles of *nature* and *nurture* in determining behavior is a good example of such a change. Watson is often considered an arch-environmentalist, an ardent advocate of nurture and the environmental control of behavior. That was certainly true of the later Watson, especially considering his popular writings in the 1920s and 1930s, but it was not true of his earlier position. In his 1914 book *Behavior: An Introduction to Comparative Psychology,* Watson described instincts as important influences on animal behavior. He outlined the long and often confused history of the term *instinct* as it is used in psychology, but concluded that "in spite of its past, the term is short, useful, and convenient" (Watson, 1914, p. 106). Watson believed at the time that much animal behavior is best described as instinctive, or "congenital responses unfolding serially under appropriate stimulation" (Watson, 1914, p. 106). Watson had often seen such instinctive behaviors in his studies of the birds of the Tortugas Islands.

By the time he published *Psychology from the Standpoint of a Behaviorist* (1919), Watson's position had shifted. The book deals almost exclusively with human behavior, and though Watson described a long list of human behaviors affected by instinct—hunting, fighting, maternal care, gregariousness, imitation, manipulation, and play—most of these behaviors are "really consolidations of instincts and habit" (Watson, 1919, p. 282). In *Behaviorism* (1924), the ascendancy of habit is complete. Watson included two chapters with the provocative title "Are There Any Instincts?" (Chapters 5 and 6). His answer was that instincts do not exist and habits are dominant. We are aggressive because we have learned to behave that way; to diminish aggressive behavior, parents must learn to care for their offspring, and children even have to learn how to play. How humans form such habits became central to Watson's behaviorism; psychologists following his lead performed thousands of experiments on habit formation. Often these experiments were done with rats, leading some to conclude that magicians and psychologists have much in common:

Magicians pull rabbits out of hats.
Psychologists pull habits out of rats!

From 1924 on, the term *instinct* had no place in Watson's psychology: he had abandoned instincts. In addition, he rejected earlier conceptions of inherited capacities, talents, abilities, penchants, and vocations. The environment was everything, so Watson was led to offer his frequently quoted challenge:

> Give me a dozen healthy infants, well-formed, and my own specified world to bring them up in, and I'll guarantee to take any one at random and train him to become any type of specialist I might select—doctor, lawyer, artist, merchant, chief and, yes even beggarman and thief, regardless of the talents, penchants, tendencies, abilities, vocations, and race of his ancestors. (Watson, 1924, p. 82)

Thus behaviorism promised a remade world, freed from the past, in which people could be conditioned to behave in acceptable ways. The question of who decides which behaviors are and are not acceptable, and which people become the doctors, lawyers, artists, and even beggars, never troubled Watson. He had faith in his vision of a new behaviorist utopia. But what of the challenge itself? Given a dozen healthy infants and total control over their nurture, would Watson have been able to make good his boast? Watson admitted that he had gone beyond the facts, and though he envisioned infant laboratories in

Johnny the Gentleman and Jimmie the Mug

In 1930, Myrtle B. McGraw (1899–1988) was appointed Associate Director of the Normal Child Development Study at Babies Hospital, Columbia Presbyterian Medical Center in New York City (Lipsitt, 1990, p. 977). As a student at Columbia, McGraw had known Watson and was familiar with his views on infant development. Watson's extreme environmentalism stood in stark opposition to the position of Arnold Gesell, a Hall Ph.D., who stressed maturation as the most important concept in developmental psychology. Gesell held that infants develop through an orderly and predictable series of stages. For Gesell, physical and psychological stages governed all aspects of development.

Against this background of competing theories of development, McGraw in 1932 began an experiment with the Woods twins, Johnny and Jimmy. Her aim was to determine whether she could alter the sequence and duration of developmental stages. One twin, Johnny, was stimulated to engage in a variety of activities; the other twin, Jimmy, was left largely undisturbed except for routine care. The twin brothers were first brought to McGraw's clinic when they were twenty days old. They remained at the clinic five days a week for about seven hours each day. For twenty-two months, Johnny was stimulated every day at two-hour intervals to engage in a range of activities, including swimming, diving, suspended grasping, erect locomotion, upright sitting, ascending stairs, and skating. Jimmy was not given any special stimulation and received only routine care at the clinic.

Early reports by McGraw and a film record she distributed stressed Johnny's precocious and superior achievements. At the age of fifteen months, he scooted around on roller skates; at nineteen months, he scrambled up steep slopes, dived into a pool and swam fifteen feet with his face in the water. Jimmy did none of these things and became increasingly cranky and temperamental. Finally, the restrictions imposed on him were abandoned at the end of twenty-two months. Jimmy was then given two-and-a-half months of intense exercise and training. McGraw reported in her 1935 book *Growth: A Study of Johnny and Jimmy* that after Jimmy's period of intense training, the differences in motor performance between the two twins were markedly reduced. Johnny then showed little advantage. Dennis (1989) summarized the results:

> Even though attempts to teach Jimmy at twenty-two months still showed Johnny to have some advantage, McGraw concluded that the performance of a child whose activities had been restricted could be brought at a later date to approximate the achievements of a child who earlier had received special stimulation. Similarly, when at twenty-four-and-one-half months both twins were subjected to exercise in activities especially new to them, such as tool construction and multiple sticks, Johnny again evidenced little advantage if his achievements were measured by end results. And, at twenty-five-and-one-half months, when the effect of a month's absence of practice on their retention of previously acquired performances was observed, Johnny showed a clear, although temporary, deterioration in practically every area, while Jimmy made his best performance in those situations in which he had previously been exercised. (Dennis, 1989, p. 362)

At twenty-six months, the twins were returned to a normal life and the

Johnny the Gentleman and Jimmie the Mug (Continued)

study essentially ended, although intermittent follow-ups were made during the next four years. The twin brothers' final results were very similar.

PRESS COVERAGE OF JOHNNY AND JIMMY

McGraw's experiment occurred in the context of intense media interest in babies and their development. The much-publicized competing views of Watson and Gesell, the tragic kidnapping of the Lindbergh baby in 1932, the birth of the Dionne quintuplets in 1934, and the continuing interest in nature and nurture all contributed to public interest. The media responded with enthusiasm. At first the coverage was positive but often exaggerated. The *Literary Digest*, in a report headlined "Johnny's a Gentleman, but Jimmie's a Mug," stated that McGraw had demonstrated that a child's development could be speeded up by proper training. *Parent's Magazine* wondered if such techniques might not allow us to produce a race of supermen. *Newsweek* predicted a brilliant future for Johnny but expected Jimmy to make a mess out of his life. The *New York Times* reported that John Dewey had referred to McGraw's experiment as comparable in importance for psychology to Faraday's experiments for physics (Dennis, 1989, p. 361). But with the later reports of little difference between the twins, the media coverage became hostile and critical, though still exaggerated. The *New York Times* stressed the achievements of the untrained twin and described the study as showing the failure of behaviorism. Johnny, it was claimed, had been conditioned using the best knowledge psychology had to offer, while Jimmy had simply gone his own way. Now the two twins were almost equal. In much of the press coverage, writers took obvious delight at what they viewed as a failure and loss of authority for psychology. They also tended to root for the underdog twin, Jimmy, and to celebrate his achievements.

This incident, among others, had a negative effect on the public perception of psychology (Benjamin, 1986). John Burnham (1987) claims that the popularization of science and the excessive claims some scientists, including psychologists such as Watson, made led to disenchantment and the dominance of superstition over science. McGraw herself, though she at first sought and welcomed the press coverage, came to regret the way the media depicted her work and its results. It seems only fair to give her the last word on Johnny and Jimmy:

> All sorts of interpretations of this study, made by all sorts of people, except the investigator, have conveyed the general impression of a "stunt," intended in some way to make a child "bright." This was not a study in intelligence; it was none of the things popularly supposed. (McGraw, 1942, p. 22)

More than forty years later, McGraw looked back on "professional and personal blunders in child development" and concluded:

> If this confession can help educate, and young researchers recognize the value of admitting blunder or mistaken judgment the process of growing up, in this society can be repaid. (McGraw, 1985, p. 170)

McGraw was too self-critical and had nothing to confess (Dalton & Bergenn, 1995).

preschools, he was never able to prove his theories. The closest Watson came to such schemes was in his numerous experiments with his own children, leading Rosalie Rayner to write a whimsical article entitled "I Am the Mother of the Behaviorist's Sons" (Rayner, 1930). Watson and Rayner's two sons both found adult life difficult. Shortly after Watson's death, his son Jimmy went into psychoanalysis, and Billy, a chronic alcoholic, committed suicide a few years later (Cohen, 1979).

Watson's Environmentalism

There were a number of reasons for Watson's switch to an environmental position. First, his move from animal to human research influenced this change. Instinctive behaviors were much less apparent in humans than in animals, and when Watson investigated certain fears and tendencies, such as handedness, that psychologists had previously ascribed to instincts or innate predilections, he found that learning and habit were involved. Second, an ever-increasing catalogue of human activities had been explained as instinctive. Often such explanations were circular: Why are there so many wars? Because humans are instinctively aggressive and territorial. How do we know that humans have such instincts? Because there have been so many wars. Such explanations explained nothing, so Watson concluded that the best position for psychology was to deny that instincts exist at all. Third, animal researchers had questioned whether some behaviors described as instinctive were, in fact, instincts. Starting with a paper called "Giving Up Instincts in Psychology" that he wrote as a senior at Berkeley (Li, 1989), Zing-Yang Kuo (1898–1970) published a series of critiques of the concept of instinct in psychology (Kuo, 1921, 1924, 1930). Kuo studied under Edward Tolman (Chapter 13) at the University of California and then returned to China, where he introduced behaviorism and made important contributions to psychology and embryology (Gottlieb, 1972). Kuo's conclusions were that many behaviors previously described as instincts are actually acquired habits and that it is possible to have a "psychology without heredity." In his best-known experiments, Kuo raised kittens and young rats together, and kittens and birds together. As adults, these animals not only tolerated each other, but even showed some affection. The cats never killed the rats, and birds raised with kittens would ride around the laboratory on the cats' backs. The so-called rat- and bird-killing instincts of the cats never appeared. Such results proved conclusively to Watson that all behaviors, including many actions formerly thought instinctive, are actually learned. A fourth reason for Watson's change in thinking is that the process of habit formation could be studied, whereas instincts were part of an animal's genetic makeup and could not be directly studied. For all these reasons, Watson became more and more an environmentalist.

Behaviorism and Child Care

In 1928, Watson, with the assistance of Rosalie Rayner, published a book on child care entitled *Psychological Care of Infant and Child.* Within a few months of

Zing-Yang Kuo (1898–1970).
(From Zing-Yang Kuo, Journal of Comparative and Physiological Psychology, *American Psychological Association)*

publication, it had sold more than 100,000 copies and was a controversial bestseller. In many ways, the book reads like Watson's and Rayner's revenge. The book's dedication, "To the first mother who brings up a happy child," seemed calculated to enrage many readers. The book presents a harsh, dogmatic behaviorist manual for raising children. Parental love and affection are minimized. The following passage is characteristic of the book's tone:

> There is a sensible way of treating children. Treat them as though they were young adults. Dress them, bathe them with care and circumspection. Let your behavior always be objective and kindly firm. Never hug or kiss them, never let them sit on your lap. If you must, kiss them on the forehead when they say goodnight. Shake hands with them in the morning. Give them a pat on the head if they make an extraordinarily good job of a difficult task. (Watson, 1928a, pp. 81–82)

For many readers, this book was behaviorism gone mad; and even Watson and Rayner did not follow such harsh procedures with their own children. Later, Mary Cover Jones was to write of *Psychological Care:*

> This is the book for which generations of mothers, including my own, have flayed Watson. He himself quoted one parent, a "dear old lady," who said, "Thank God, my children are grown up and that I had a chance to enjoy them before I met you." (Jones, 1974, p. 582)

Watson became quite defensive about the book and later admitted:

> *Psychological Care of Infant and Child* was another book I feel sorry about not because of its sketchy form, but because I did not know enough to write the book I wanted to write. I feel that I had a right to publish this, sketchy as it is, since I planned never to go back into academic work. (Watson, 1936, p. 280)

A very different view of children and how they should be raised was presented by Benjamin Spock in *The Common Sense Book of Baby and Child Care* (1943). In 1945, the title was changed to *Baby and Child Care.* This manual, published in multiple editions, has sold 25 million copies around the world.

Watson's Later Life

After 1930, Watson had little involvement with psychology. He did not read or contribute to psychology journals, seldom met academic psychologists, and became the forgotten man of psychology. He lived with his family on a forty-acre estate near Weston, Connecticut, and became, as his son Billy said, "suburbanized." He kept animals, built a magnificent barn, and made a great deal of money from his advertising career. He left the J. Walter Thompson agency in 1935 and spent the last ten years of his career with William Esty & Company. Rayner contracted a tropical fever on a trip to the West Indies and died in 1935. Watson retired in 1945 and spent his time looking after his animals and puttering in his garden.

Late in life, Watson received two important recognitions. First, in 1956, Gustav Bergmann published a positive evaluation of Watson's contributions to psychology. He described Watson as second only to Freud in the history of psychology and concluded:

> Yet I have not the slightest doubt that with all the light and all the shadow, he is very much a major figure. Psychology owes him much. His place in the history of our civilization is not inconsiderable and it is secure. Such men are exceedingly rare. We ought to accept them and appreciate them for what they are. (Bergmann, 1956, p. 276)

Despite this opinion, Bergmann characterized Watson's understanding of science as "silly," his social philosophy as "deplorable," and much of his general philosophy as "patent nonsense." Forty years earlier, such comments would have elicited a vigorous Watsonian response; in 1957, they met only suburban silence. That same year, Watson was awarded the APA's gold medal for his contributions to psychology. He traveled to New York City to attend the APA convention and accept the award, but at the last minute found himself so overwhelmed by anxiety that he sent his son Billy to the convention in his place. However, he was deeply moved by the award and the accompanying citation:

> To John B. Watson, whose work has been one of the vital determinants of the form and substance of modern psychology. He initiated a revolution in psychological thought, and his writings have been the point of departure for continuing lines of fruitful research. (Karier, 1986, p. 148)

When a new reprint of *Behaviorism* was published in 1958, Watson dedicated it "in gratitude" to the members of the APA. He died on September 25, 1958.

A final posthumous recognition was especially appropriate. In April 1979, a symposium at Furman honored the centennial of Watson's birth. Two thousand people attended, with B. F. Skinner as the featured speaker. The psychology laboratories at Furman were dedicated in Watson's name.

How different would the history of psychology have been if Watson had had a full academic career? One can only speculate, but surely with his brilliance, creativity, and aggressive personality, his contributions would have been important. Perhaps his behaviorism would have matured to become more like the psychologies we will discuss in Chapter 13.

Edward Tolman.
(Archives of the History of American Psychology, University of Akron)

CHAPTER 13

Four Neobehaviorist Psychologists

With its founder, John Watson, exiled from psychology, *behaviorism* might have been expected to decline in importance and influence. But that was not the case. The *neobehaviorist* psychologists in this chapter modified and expanded Watson's behaviorism but accepted his rejection of consciousness, his definition of psychology as the "science of behavior," and his insistence on objective, observational data—his *methodological behaviorism.* The approaches of these psychologists dominated psychology from 1940 to 1970. However, the neobehaviorists were never a tight little school of psychology, and different approaches to the study of behavior soon emerged. A common theme was a concern for the level of behavioral analysis to be employed. Should the approach be *molar*—that is, concerned with purposive acts and cognition; or *molecular*—a search for a unit of behavioral analysis similar to the reflex arc of the physiologists? The four psychologists we will consider in this chapter—Edward Chace Tolman, Edwin Ray Guthrie, Clark Leonard Hull, and B. F. Skinner—all formulated neobehaviorist approaches to psychology that addressed this issue, with some similarities but many differences. These differences gave vitality and impetus to the behaviorist movement in American psychology and led to an extremely productive period of behavioral theory and research (Jenkins, 1979).

EDWARD CHACE TOLMAN (1886–1959)

Tolman's Early Life

Edward Chace Tolman was born in Newton, Massachusetts, in 1886, the third child and second son of an upper-class New England family. His father was president of a manufacturing company and a staunch believer in the Puritan ethic of hard work and constant effort. One of the older Tolman's favorite mottoes was "Tend to business." Tolman's mother had a Quaker background. She was a warm, caring person who loved her children deeply and tried to instill in them her Quaker values of plain living and high thinking. Tolman attended the excellent public schools in Newton and followed his older brother, Richard

Tolman, to the Massachusetts Institute of Technology (MIT). In his autobiography, Tolman explained he chose to enter MIT because of family pressure. His father had been a member of MIT's first graduating class and was a university trustee.

Tolman majored in electrochemistry and graduated with a B.S. degree in 1911. During his senior year, he read a book that changed his and many other people's lives, William James's *Principles of Psychology* (Chapter 9).[1] Tolman had always been interested in "what makes people tick." He found James's psychology captivating and decided to abandon physics, chemistry, and mathematics to study psychology and philosophy. As he admitted in his autobiography, an additional reason for the switch was his reluctance to compete with his older brother, who had graduated from MIT and quickly begun a promising career as a theoretical physicist and chemist. Richard Tolman's career culminated in his work as an associate of Robert Oppenheimer on the atomic bomb project at Los Alamos (Rhodes, 1986).

The summer after his graduation, Edward Tolman enrolled at Harvard and took a course in philosophy and one in psychology with Robert Yerkes (Chapter 11). He liked both courses but decided that he "did not have brains enough to become a philosopher" (Tolman, 1952, p. 323). He then enrolled as a graduate student in Harvard's department of psychology. For the rest of his life, Tolman's devotion to psychology never wavered. At Harvard he worked in the laboratory of Hugo Münsterberg. As we saw in Chapter 5, by 1911 Münsterberg's interests were concentrated on applied topics, and he left the direction of the laboratory to his assistant, Herbert S. Langfeld. However, Münsterberg made a point of attending the laboratory's meetings, in which students presented and discussed their research.

Invariably, Münsterberg opened these meetings with a brief lecture describing introspection as the method of psychology; then the students and research assistants would describe experiments in which introspection was seldom used. To Tolman's practical mind, something was clearly wrong. If, as Münsterberg claimed, introspection was indeed *the* psychological method, why was it used so seldom in his laboratory? Tolman was also troubled by the thought that if Münsterberg were correct, he and the other graduate students at Harvard would be well-advised to transfer to Cornell University, where they could be instructed in introspection by the master himself, Edward Titchener (Chapter 5). Since his fellow graduate students showed no inclination to leave for Cornell, Tolman concluded that something was amiss. Fortunately, he enrolled in a second course with Yerkes that helped resolve his conflict. Yerkes used as his text Watson's recently published *Behavior: An Introduction to Comparative Psychology* (Chapter 12) and defended Watson's definition of psychology as a science of behavior that has no need for introspection. When Tolman

[1] In a humorous paper published in the *Journal of Polymorphous Perversity,* W. Scott Terry (1984) described twelve Prescriptions for Fame in the History of Psychology. One of them is to read William James's *Principles of Psychology.* Others that may sound familiar to readers of this book are to be a graduate student under Wundt, have a nervous breakdown, be the first to do something, or be an experimental psychologist.

considered the work he and others in Münsterberg's laboratory were actually doing, he concluded that Watson's definition made sense.

At the end of his first year of graduate studies, Tolman went to Germany to prepare for his doctoral language examination in German. He spent a month with Kurt Koffka at the University of Giessen, where he was introduced to *Gestalt* psychology. As we saw in Chapter 7, in 1912 *Gestalt* psychology was full of vigor and excitement. Tolman was impressed, though he later recalled sensing only vaguely what *Gestalt* psychology was about. However, the *Gestalt* psychologists made a definite impression, and ten years later, in 1923, Tolman returned to Giessen to learn more about their approach to psychology. Kurt Lewin's views were especially important in influencing his decision, and Tolman always acknowledged his indebtedness to Lewin and the *Gestalt* psychologists.

Tolman's dissertation research at Harvard concerned memory for nonsense syllables learned in the presence of pleasant or unpleasant odors. He received a Ph.D. degree in 1915 and then taught as an instructor at Northwestern University for three years. During this period, he published his first research papers on the conventional problems of imageless thought, retroactive inhibition, and association times for pleasant and unpleasant words. He recalled later that "at the time, the behavioristic point of view had not yet really got into my blood" (Tolman, 1952, p. 329). In 1918, Northwestern went through a wartime retrenchment, reducing the number of teaching positions. Tolman lost his position because, it was said, he had been an ineffective teacher; but Tolman always believed that the real reason had been his pacifist and antiwar activities. In any event, Tolman was dismissed by Northwestern and was fortunate to find a position at the University of California at Berkeley. He found California and the freedom of the West immediately appealing. Tolman believed that Berkeley provided an ideal academic environment and remained loyal to the University of California for the remaining four decades of his life.

Tolman's Cognitive Behaviorism

Thoughtful Maze-Learning Rats One product of Tolman's new sense of freedom was a resolve to break with conventional psychology and explore behaviorism. At Berkeley, he developed a new course on comparative psychology that he taught with Watson's book as a text. Tolman also acquired some rats, built a number of mazes, and began to study rats' maze learning. He quickly became convinced that accounts of maze learning that emphasized the mechanical stamping in or out of connections between stimuli and responses did not adequately describe the behaviors he was observing. There seemed to be more to the behavior of his rats than being prodded back and forth by stimuli, rewards, and punishments. Far from behaving in a mechanical, unthinking fashion, the rats appeared to Tolman to behave with intelligence and purpose. They wanted certain things and learned how to reach them. Tolman treated maze learning as a cognitive molar phenomenon and believed that his rats learned the general pattern or layout of the maze in what Tolman was to term a *cognitive map* of the maze (Tolman, 1948).

Purpose and cognition became the central concerns of Tolman's *molar behaviorism.* Watson had excluded them, an exclusion Tolman considered a grave error. He aimed to develop a new, "sensible" behaviorism based on objective observations of behavior but including the analysis of purpose and cognition. Tolman outlined his views in a series of papers published in the 1920s (Tolman, 1922, 1923, 1926) and then in his celebrated book *Purposive Behavior in Animals and Men,* published in 1932. Despite its title, he devoted most of the book to descriptions and analysis of the behavior of rats in mazes and with a nice sense of humor dedicated it to "MNA"—*Mus norvegicus albinus,* the white rat.

Tolman began *Purposive Behavior* with a vigorous attack on mentalistic psychologies and a strong endorsement of the behaviorist approach. Psychology, he argued, should be an objective science of behavior and focus on such molar behaviors as:

> A rat running a maze; a cat getting out of a puzzle box; a man driving home to dinner; a child hiding from a stranger; a woman doing her washing or gossiping over the telephone; a pupil marking a mental-test sheet; a psychologist reciting a list of nonsense syllables; my friend and I telling one another our thoughts and feelings—these are behaviors (*qua molar*). (Tolman, 1932, p. 8)

Such molar acts, according to Tolman, are purposive, goal-directed, and cognitive. A rat in a maze learns not only that a reward will be in the goal box, but that a specific reward will be there. Different rewards have different values and affect behavior differentially. In an experimental demonstration of such effects, one of Tolman's students, R. Simmons, ran groups of rats at the same level of hunger through a maze for different rewards. Rats running for bread and milk ran fastest, those given sunflower seeds ran the next fastest, and rats that simply were removed from the goal box when they reached the end of the maze ran the slowest. Certain rewards were more "demanded" than others. These rewards acted as "immanent determinants" of maze running (Simmons, 1924).

Tolman and his students were also able to show that the rats learned to expect a particular reward and were disappointed when they found a less demanded reward in its place. Attributions of "disappointment" to maze-running rats sound like behaviorist heresy, but in an elegant series of experiments Tolman observed behaviors he considered a clear indication of such reactions. When rats that had been trained with a highly demanded reward encountered a less demanded one on later trials, they ran more slowly and made more errors. Similarly, rats trained first with a less demanded reward improved their performance when the more demanded reward was substituted (Elliott, 1928). To Tolman, such changed behavior after the substitutions constituted clear, objective evidence that his rats had acquired specific expectations and had been "disappointed" or "elated" when their expectations were not met.

Experiments by Otto Tinklepaugh also showed such specific expectations in monkeys. From 1925 to 1927, Tinklepaugh had worked with Wolfgang Köhler (Chapter 7) before joining Tolman at Berkeley. With a research budget of $50, he ran memory experiments in which a piece of banana was placed under one of two cups in full view of a restrained monkey. Thus far, the experiment was very much like the ones Köhler conducted on Tenerife (Chapter 7); the difference was that in Tinklepaugh's experiment, the experimenter, while hidden from the monkey's view, substituted a piece of lettuce for the banana. When released, the monkey:

> Jumps down from the chair, and rushes to the proper container and picks it up. She extends her hand to seize the food. But her hand drops to the floor without touching it. She looks at the lettuce, but (unless very hungry) does not touch it. She looks around the cup and behind the board. She stands up and looks under and around her. She picks the cup up and examines it thoroughly inside and out. She has on occasion turned towards observers present in the room and shrieked at them in apparent anger. (Tinklepaugh, 1928, p. 224)

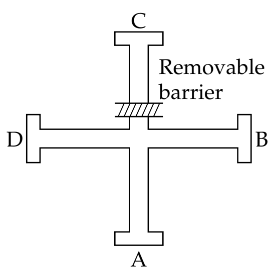
Tolman believed that even an avowed behaviorist who saw the monkey's behavior would be forced to agree that she had "expected" to find banana and was "disappointed" to find lettuce.

Latent Learning But what if animals first found no rewards and then encountered them? Would they be "surprised" and change their behavior? Hugh Blodgett reported the first of an important series of experiments using this paradigm in 1929. Three groups of rats were trained to run through a six-unit maze. They were given one trial per day. Group 1, the control group, was fed upon reaching the goal box. Group 2, the first experimental group, did not find food for the first six days of training, but on the seventh day they found food in the goal box and continued to find it there for the rest of the experiment. Group 3, the second experimental group, ran without food for two days, found food in the goal box on the third day, and continued to find it there for the rest of the experiment. Both experimental groups showed a marked reduction in the number of errors made in running the maze the day after the transition from nonreward to reward conditions, and this improved performance continued for the rest of the experiment. Clearly, the rats had learned the maze during the initial nonreward trials, and they were able to use this cognitive map of the maze when rewards were introduced.

Tolman termed the initial learning during the nonreward trials *latent learning* and argued that such learning is pervasive in the everyday experience of humans (Tolman, 1932, p. 343). We drive or walk along the same route each day, and in doing so we learn the locations of stores, parks, banks, bus stops, and the like, but this learning is latent. It is only when we need to find a specific park, store, or bus stop and can do so that such learning becomes manifest. Tolman's report of latent learning in rats stimulated a great volume of research. While it provoked some controversy, numerous investigators reported evidence that rats do in fact learn in the absence of rewards (Thistlethwaite, 1951). The phenomenon is both reliable and robust. Latent learning challenges the assumption that learning can occur only with reinforcement. Some law-of-effect learning theorists responded to this challenge by claiming that some type of reinforcement must have been present during the initial nonreward trials. Since they believed that reinforcement is necessary for learning and since rats in latent learning experiments clearly do learn, such a claim was required. But what was the reinforcement? Some posited that reduction of a rat's curiosity about the maze or a reinforcing feeling of freedom following removal from the goal box might have been "minimally reinforcing" and thus have supported learning during the initial trials. The details of such claims will not be considered here, but we should note that in postulating a "higher" curiosity drive and feelings of freedom, law-of-effect theorists were clearly broadening their positions, just as Tolman hoped they would.

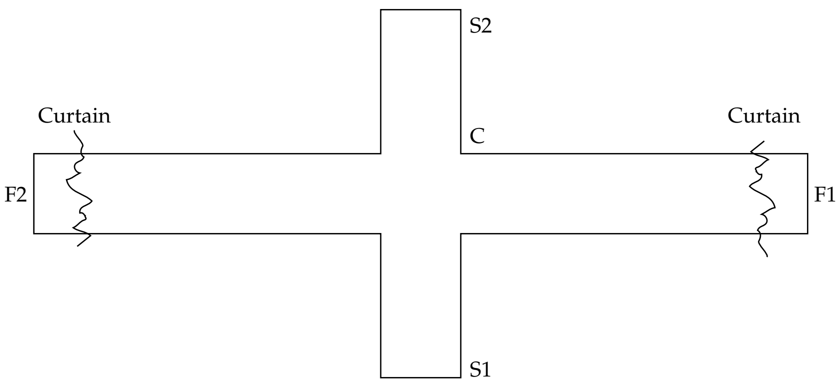
Tolman's Insight-Learning Experiments In *Purposive Behavior,* Tolman also reported the results of a brilliant experiment on rats' *insight learning.* Tolman was familiar with Köhler's experiments on apes' insight learning (Chapter 7) and had commented favorably on them. His aim was to show similar behaviors in maze-learning rats. Together with C. H. Honzik, Tolman conducted an experiment using an elevated maze that had paths without sidewalls so that a rat could see the whole maze from any point. The maze had three routes of different lengths from the starting point to the goal box, but they all had a final common path. First Tolman and Honzik allowed the rats to explore the maze. Then the rats were made hungry and quickly learned to take the shortest and most direct path to food. They behaved in accordance with what Tolman termed the *law of least effort;* that is, given a choice between a number of paths to a reward, animals generally choose the one that requires the least effort. Next, a barrier was introduced so that the shortest path was blocked, but the remaining two paths were open. When rats reached the barrier, they retreated and took the next shortest unblocked path. Finally, a second barrier was erected, blocking both of these paths. After encountering this barrier, the rats immediately switched to the only remaining unblocked path. Tolman believed that his rats had shown *insight.* He believed they had learned a *cognitive map* of the maze that was not just a narrow "strip map" of a particular path to the goal, but a broad map of the maze as a whole. Finding one path to the goal blocked, the rats were able to use their cognitive maps in selecting the next shortest unblocked path. This experiment was indeed an ingenious demonstration of insight learning by rats.

Place versus Response Learning Tolman was elected president of the APA in 1937. In his presidential address, "The Determiners of Behavior at a Choice Point," he described additional experiments designed to illustrate cognitive, purposive behavior in rats. In one of these experiments, Tolman used this simple apparatus in a room with a number of prominent landmarks:



A is the start box, and B is the goal box. A hungry rat quickly learned to run without hesitation to B, but what had it actually learned? One possible answer is that the rat had learned to make a specific *response*—turning right—because that response led to food. Tolman favored a different answer. He believed that the rat had developed a cognitive map of the maze with the *place* of reward marked. With only the results from initial learning, there is no evidence supporting one of these answers over the other. The "Tolmanians," or, as they sometimes called themselves, "Tolmaniacs," provided an ingenious test. Once a rat had learned to run from A to B, it was started from C. This would require a different behavior at the choice point. The S-R hypothesis predicts that the rat should make the learned response—that is, turn right and so reach D; the cognitive map theory predicts that the rat will refer to its cognitive map, locate the marked reward location, and go to it, thus reaching B. On the test trial, the majority of rats reached B, leading Tolman to conclude that in learning the maze, the rats had acquired a spatial representation of the apparatus as a whole—a cognitive map, rather than specific responses to individual stimuli within the apparatus.

A second method of assessing *response* versus *place learning* was to determine which type the rats more readily learned. Tolman, Ritchie, and Kalish (1946) built the elevated maze shown in the following diagram:



Response-learning rats started randomly from S1 and S2, but always found food by turning right; place-learning rats also started randomly from S1 or S2, but always found food in the same place. All eight rats in the place-learning group learned to run to the correct place within eight trials. None of the response-learning rats learned that quickly, and five of them did not learn even after seventy-two trials.

At choice points, Tolman's rats often vacillated, looking back and forth at the alternative paths before making a choice. Tolman described their behavior as "vicarious trial and error." According to Tolman, "VTE-ing," as it came to be called, reflects a rat's "search for the stimulus" and for the experimenter's "instructions." It is part of the animal's attempt to learn "what leads to what" in a particular situation (Tolman, 1932, chapter XIII).

Tolman's Theoretical Model

While these were important investigations, they are only a small sample of the research program Tolman directed. He published over one hundred papers and two books describing his research and theory of behavior. In "The Determiners of Behavior at a Choice Point" (Tolman, 1938), he described three classes of variables that influence behavior: independent, intervening, and dependent variables. Independent variables refer to conditions of the experiment that the experimenter can manipulate, such as the animal's maintenance schedule, the type of goal object, the types and modes of stimuli provided, the responses required, and the number and distribution of trials. Each of these independent variables in turn influences an intervening variable: demand, appetite, differentiation, motor skill, and hypotheses and biases, respectively. Tolman reported on experimental investigations of the relationships between these independent and intervening variables.

A second class of independent variables relate to the individual, including qualities such as heredity, age, previous training, and special endocrine or drug conditions. In most experiments, psychologists attempt to hold these variables as constant as possible by, for example, using large groups of standard animals, between the ages of 90 to 120 days, with no previous training and no special endocrine or drug conditions.

Finally, psychologists look at various dependent variables: maze-running speed, number of errors, number of VTEs at choice points. These dependent variables allow the researcher to measure the strength of intervening variables. Tolman's model of independent, intervening, and dependent variables has been widely used in psychological research.

Tolman's General Concerns

Tolman hoped to develop a comprehensive behavior theory that would have a broad range of applications. As he said, "Rats in mazes are very nice. But, after all, they do not constitute the whole universe of behavior" (Tolman, 1932, p. 182). He admired the *Gestalt* psychologists, especially Kurt Lewin, whose ideas he had "borrowed time and again and absorbed into my very blood" (Tolman, 1952, p. 339). Tolman's goal was a psychological system, like Lewin's, that would include the complexities of human thought and motivation together with such social problems as aggression and war. He hoped for something more than a "rat-runners psychology." Chapters in the second half of *Purposive Behavior* discuss inventive ideation, speech, sensation, perception and image, feeling and emotion, and personality and include some conclusions for philosophers and psychologists. In a paper entitled "Psychological Man" written in 1941, during World War II, Tolman discussed human drives to aggression and the motives that lead to wars. His paper begins with this moving passage:

> There has come a frenzy in the tides of men. Social forces whose power we have not understood or, if we have understood, we have been helpless to control, have sucked us into a dark whirlpool. (Tolman, 1941, p. 205)

Tolman considered the question of what psychologists could say and do at such a terrible time. A year later, in 1942, he published *Drives Toward War.* In this book, he combined his own concepts with certain Freudian ideas and used them to try to understand human drives that lead to the devastation of war. Tolman also considered such clinical phenomena as regression, fixation, and displaced aggression onto outgroups and tried to explain them using the concepts he had developed in his animal research.

A number of times during his long career, Tolman supported causes he believed important. Perhaps the most dramatic was his support of colleagues, especially younger faculty members, during what came to be known as the "year of the oath" (Stewart, 1950) at the University of California. In 1949, the California Regents decided that in addition to the traditional oath of loyalty to the state of California, university employees would be required to swear a codicil that read: "I swear that I am not a member of the Communist Party or under any oath, or a party to any agreement, or under any commitment that is in conflict with my obligation under this oath." Faculty members were instructed to "sign or get out." Tolman refused to sign. He pointed out that it would have been relatively easy for him to "get out," but much more difficult for younger people just beginning their careers. Tolman chose to stay and to head the opposition that caused the Regents to eventually withdraw the oath in 1950. The University of California Regents' decision to confer an honorary LL.D. degree on Tolman in 1959 recognized his integrity in this struggle.

Tolman wrote with wit and grace. In the sometimes ponderous literature of psychology, his stylish writings stand out. While he was devoted to psychology and the scientific analysis of behavior, Tolman never took either himself or his experiments too seriously. He had a talent for *neologisms,* and many of the expressions he formulated are now part of the terminology of psychology: sign-gestalt expectation, sign-significate relations, cognitive map, means-end readiness, discriminanda and manipulanda, and perhaps most colorful of all, schematic sowbug, a term Tolman used in predicting VTE in discrimination learning (Tolman, 1939).

Tolman received many honors and awards. He was president of the APA in 1937 and chairman of Lewin's Society for the Psychological Study of Social Issues in 1940. He was a member of the Society of Experimental Psychologists and the National Academy of Sciences. In 1957, the APA gave Tolman an award for distinguished scientific contributions. The remarks he made upon receiving this award are characteristic of his modest approach:

> This is really all I have to say. It is not too brilliant an account; but I do want to point out that such experiments were fun to do, although they took a long time and although the results when we got them persisted in being slight, confused, and somewhat sleazy. They did give us, anyway, a beautiful chance to speculate about vector models, and this, too, was fun. But, whether such experiments or such models will in the end have any world-shattering importance seems doubtful. . . . But as it is, I am stuck with these sorts of data and these sorts of models, and I intend to go on playing with them. . . . In short, we will have a delightful time and absolutely no dull moments. (Tolman, 1957, quoted by Crutchfield, 1961, p. 141)

Tolman liberated behaviorism from the methodological and theoretical constraints Watson had imposed. His use of such concepts as purpose and intent, along with the ingenious experimental paradigms devised in his laboratory, expanded the behaviorist approach. For a number of years after his death, Tolman's reputation was in decline, but over the past two decades, numerous psychologists interested in learning and behavior have applied cognitive concepts such as working and long-term memory, internal representations, language and thought (Smith, 1982). Contemporary accounts of animal learning and behavior no longer view animals as passive, mechanical systems but rather in a Tolmanian way as active, information-acquiring and -processing beings. Today animal cognition is no longer the oxymoron[2] it once was, and cognitive formulations incorporating Tolman's concepts and assumptions are central to much of the psychology of animal learning.

EDWIN RAY GUTHRIE (1886–1959)

Guthrie's Early Life

William McDougall (1933), the expatriate British psychologist, classified behaviorists as "strict, near, and purposive" types. Watson was the quintessential strict behaviorist, and Tolman and McDougall himself were of the purposive variety, while Guthrie was a "near" or perhaps commonsense behaviorist. Edwin Ray Guthrie was born in Lincoln, Nebraska, in 1886, the oldest of five children. His father operated a piano store, and his mother had been a grade school teacher. Guthrie was a precocious child. He showed his academic talent early, and in the eighth grade read Darwin's books. In high school, his senior thesis was so well-reasoned and written that his high school principal, H. K. Wolfe, interviewed him to make sure it had not been plagiarized. It had not, and Guthrie graduated from high school with a brilliant record.

In 1903, Guthrie entered the University of Nebraska, where he majored in mathematics. He also took several courses in philosophy and the only course in general psychology the university offered. Guthrie graduated in 1907 with *Phi Beta Kappa* honors and continued his studies as a graduate student at Nebraska. He earned a master's degree in philosophy while taking a number of graduate courses in mathematics and psychology. In a research course with Thaddeus Bolton, he devoted a winter to measuring thresholds for the perception of "twoness," a psychophysical experience that quenched forever Guthrie's interest in that area of psychology. Fortunately, he also took a number of psychology courses with his former high school principal, H. K. Wolfe, that were more interesting. Wolfe obtained his Ph.D. from Wilhelm Wundt in 1886, returned to the United States in 1889, and took a position as chairman of the department of philosophy at the University of Nebraska. In addition to philosophy, Wolfe taught general, pedagogical, and experimental psychology.

[2] oxymoron, n. A figure of speech by which a locution produces an effect by a seeming self-contradiction, as in "cruel kindness" or "to make haste slowly" (RHDEL, p. 1033).

Edwin R. Guthrie.
(Archives of the History of American Psychology, University of Akron)

He also established a psychological laboratory that he constantly sought to equip and improve (Benjamin & Bertelson, 1975). In 1897, Wolfe was accused of being uncooperative and of "intermeddling" in the affairs of other departments. His appointment at Nebraska was terminated. Despite student petitions and a mass protest meeting in his behalf, he was forced to leave the university. Wolfe spent the next eight years as the principal of a number of high schools, including Guthrie's. In 1906, a new chancellor of the university invited Wolfe to return to the faculty. He was an inspirational teacher, and the department of psychology he established at Nebraska has had the distinction of seeing more of its undergraduate students go on to become president of the APA than any other college or university (Benjamin & Bertelson, 1975). Guthrie was one of the many APA presidents from Nebraska. More than fifty years later, Guthrie acknowledged his "good fortune to be his [Wolfe's] only student" (Guthrie, 1959, p. 160). During his three years as a postgraduate student at Nebraska, Guthrie also taught mathematics in a Lincoln high school.

In 1910, Guthrie entered the University of Pennsylvania as a postgraduate fellow in the department of philosophy. During his Christmas vacation he attended the annual meeting of the American Philosophical Association and heard a philosopher, Edgar Arthur Singer, deliver an address entitled "Mind as an Observable Object." Twenty-five years later, Guthrie recalled Singer's address as "the most stirring event of my academic life" (Guthrie, 1935, p. vii). What captured his interest was Singer's contention that one can study the mind objectively within the framework of science. Singer was on the faculty of the department of philosophy at the University of Pennsylvania, and so Guthrie was able to take a Ph.D. with him. Guthrie's thesis was in the area of symbolic logic and dealt with Bertrand Russell's paradoxes—that is, with propositions whose truth implies their falsity or whose falsity implies their truth; for example, "All generalizations are invalid." Guthrie received a Ph.D. in 1912, but he found his interest in philosophy weakening. Such philosophical exercises as those of Bertrand Russell and Alfred North Whitehead in their *Principia Mathematica* required "some 400 pages to establish the conclusion that one plus one equals two, and that every intervening step could be challenged and would require more proof, and that the steps of these added proofs would require still more . . ." (Guthrie, 1959, p. 161). Such exercises made Guthrie doubt that deduction alone could ever lead to an understanding of the human mind.

After receiving his Ph.D., Guthrie taught mathematics in a Philadelphia high school for three years before accepting a position as an instructor in philosophy at the University of Washington. He remained there from 1914 until his retirement in 1956, transferring to the department of psychology in 1919 and being appointed a professor in 1928, dean of the graduate school in 1943, and the university's executive officer in 1947. These administrative positions undoubtedly restricted his contributions to psychology. Nevertheless, his was an important neobehaviorist voice.

Learning Through Contiguity

Guthrie's most important contribution to psychology was his theory of learning, or what he called with characteristic modesty his "point of view" or "rudiments" of a system of learning. He presented his position in two major theoretical papers in 1930 and 1934; in his best-known book, *The Psychology of Learning,* published in 1935; and in a third theoretical paper in 1940. Guthrie's view of learning was concise and simple: all learning is based on contiguity between stimuli and responses. "Stimuli which accompany a response tend, on their recurrence, to evoke that response" (Guthrie, 1930, p. 412). In *The Psychology of Learning,* Guthrie stated this principle of contiguity in similar words: "A combination of stimuli which has accompanied a movement will on its recurrence tend to be followed by that movement" (Guthrie, 1935, p. 26). The last movements in a situation will be repeated when that situation recurs. The principle of contiguity is elegant and simple, especially in contrast to the complex accounts of learning other neobehaviorists proposed. Even Tolman's view of learning became increasingly complex. In one of his last major statements (1959), he devoted many pages to complex diagrams showing multiple interactions and relationships between independent, intervening, and dependent variables. As we will see later in this chapter, Clark Leonard Hull's learning theory also became very elaborate, and B. F. Skinner coauthored a 750-page book describing the effects of schedules of reinforcement, just one aspect of his operant approach. The principle of association through contiguity can be traced to Aristotle (Chapter 1). The British empiricists James Mill, Alexander Bain, and David Hartley (Chapter 2) gave it a full exposition. Guthrie believed that a general account of learning could be based on this ancient principle.

At first sight, Guthrie's principle of association through contiguity seems inadequate as an explanation for learning. What about the effects of reward and punishment? What about practice? What about forgetting, and Pavlov's temporal trace conditioning experiments? In those experiments, minutes separated the conditioned and unconditioned stimuli, yet his dogs gave conditioned responses to the CS. Since there was no temporal contiguity between the CS and unconditioned stimulus (US), how could that be? At first glance these questions presented a serious challenge to Guthrie, but in fact he was able to answer all of them. Consider first his analysis of the effects of reward and punishment. Guthrie had no quarrel with the "popular and well-established view" that reward and punishment affect learning. What he did dispute was Thorndike's belief that they act to somehow "stamp in" or "stamp out" habits. According to Guthrie, a cat in a puzzle box learns to escape because that response removes the animal from the stimulus situation of the puzzle box and so preserves an association between the stimulus and the escape response. Food does not stamp in or strengthen a stimulus-response connection; rather, it protects an association that has already formed. In other words, food does not cause learning; it protects against unlearning. Guthrie said:

> What encountering the food does is not to intensify a previous item of behavior, but to protect that item from being unlearned. The whole situation and action of the animal is so changed by the food that the pre-food situation is shielded from new associations. (Guthrie, 1940, p. 144)

For Guthrie, the ultimate function of reward is to remove an animal from a particular stimulus situation and thus prevent it from unlearning an association that has already been formed. The role of rewards is to keep the response "faithful" to the stimulus.

But what about punishment? Surely annoyers and punishers produce learning. Responses that lead to such negative consequences are usually suppressed. Guthrie agrees that indeed they are:

> Sitting on tacks does not discourage learning. It encourages one in learning to do something else than sit. It is not the feeling caused by punishment, but the specific action caused by punishment, that determines what will be learned. (Guthrie, 1935, p. 158)

Punishers elicit actions, and it is those actions that are learned:

> The animal on a charged grid, a barefoot boy on a hot pavement, a man sitting on a tack have as their goals mere escape from the intense stimulation that causes general tension and restlessness as well as specific movements. (Guthrie, 1935, p. 165)

When these "maintaining stimuli" are removed, there is contiguity between the stimuli and the response. When they recur, the response occurs again. Learning occurs through contiguity, but in this case with aversive stimuli.

Another well-established fact concerns the effects of practice. Guthrie acknowledged that both psychological research and everyday experience show that practice does indeed produce improved performance. How can that be, since there should be contiguity on the first occasion when a response occurs and thus immediate learning independent of practice? In responding to this challenge, Guthrie distinguished between *movements* and *acts* (Guthrie, 1940). He pointed out that our everyday language usually refers to acts—we sail a boat, eat dinner, ride a horse, play a piano, shoot a basketball—and to their results rather than to the movements that constitute them. Certainly all these acts improve with practice. We see an obvious difference between a maestro and a novice, a professional basketball player and a weekend player, and so on. But this difference, according to Guthrie, is a consequence of improvement in the numerous movements that make up these complex acts. It is those movements that we refine with practice and whose association with the stimulus is established. The novice responds in a clumsy, uncertain, inefficient manner; the expert, in a smooth, sure, and efficient way. Their acts may be similar—they both play the piano or shoot the basketball—but their movements are very different. Practice works on these movements.

What about forgetting? Guthrie explained forgetting as being caused by the formation of new associations through contiguity. If there were no new associations, there would be no forgetting. He stated that "learning does not disappear as the result of a mere lapse of time, but only when that lapse of time includes new learning which erases the old" (Guthrie, 1935, p. 117). Guthrie cited Pavlov's results showing that a conditioned response would often remain for many weeks without noticeable weakening. He argued that such conditioned responses are stable because the experimental animal does not encounter the conditioned stimulus in its everyday life, and so the association is protected. Guthrie predicted that if Pavlov's dogs had encountered the CSs in their everyday life, forgetting (extinction) would have been much more rapid. Guthrie also used the results of an experiment by John Jenkins and Karl Dallenbach (1924) on the effects of sleep on memory. These authors found that material learned just before a subject went to sleep was better retained than was material learned prior to waking activities. Sleep, said Guthrie, prevented the learning of new associations, and so the old ones were protected. Finally, Guthrie cited the everyday experience of putting on ice skates at the beginning of the winter. Usually one finds that skating is easy, even though many months have passed since the last skating session. According to Guthrie, the movements involved in ice skating are unique and thus are not reconditioned by our summertime activities.

The final challenge to Guthrie's contiguity view of learning seems the most serious at first sight. How could he account for trace conditioning? Pavlov found that conditioned responses can be established and maintained even when the CS precedes the US by a long time interval, sometimes even minutes. How, then, can there be contiguity between the stimulus and response? Guthrie argued that when a CS such as a bell or buzzer is presented, the dog responds by listening to it, and the listening response continues when the bell is no longer ringing; that is, the listening response persists through the trace interval. Guthrie wrote:

> When the bell rings, the dog responds by "listening," which is a series of movements, postural changes, turning of the head, pricking up the ears, and the like. When the salivary glands begin to secrete, the accompanying stimuli are not furnished by the bell but by these responses to the bell. (Guthrie, 1930, p. 418)

Guthrie's analysis of his results caused Pavlov to write "The Reply of a Physiologist to Psychologists" (Pavlov, 1932), the only paper he ever published in an American journal of psychology. Pavlov devoted almost half the paper to a highly critical rebuttal of Guthrie. First, Pavlov contrasted Guthrie's approach, in which the conditioned reflex is used to illustrate a principle of learning, with his own approach, in which the conditioned reflex is a phenomenon that must be analyzed and reduced to its physiological basis. Second, with reference to Guthrie's analysis of temporal conditioning, Pavlov reported that the "listening response" Guthrie had described is part of the "orienting reaction," a reaction that quickly disappears. Thus, Guthrie had postulated a nonexistent reaction as the basis of temporal conditioning. Rather than engaging in a series of active, substitute responses, Pavlov reported that during long trace and delay intervals between the CS and the US, a dog was often:

> . . . completely indifferent and quiet in the first period of action of the conditioned stimulus; or even (as is not seldom the case) immediately upon the beginning of that stimulus, he drops into a drowsy and sometimes abruptly into a sleeping state, with relaxation of the musculature. (Pavlov, 1932, p. 95)

Where, then, Pavlov asked, were the movement-produced substitute stimuli to which, as Guthrie claimed, conditioning had occurred? According to Pavlov, trace conditioning and delay conditioning are based on active, central inhibition of the conditioned reflex. Guthrie, he said, had made "incorrect use" of the facts of conditioning. It is clear from the tone of Pavlov's reply that Guthrie had made him angry. This is perhaps not a surprising reaction, for at one point Guthrie had claimed that Pavlov's explanations of delay conditioning assumed "mysterious latencies in the nervous system" (Guthrie, 1930, p. 418).

Guthrie, like Tolman, had a talent for coining descriptive phrases. Thorndike's explanation of the effects of delayed rewards he called a "cerebral hangover"; Tolman's rats VTE-ing at a choice point were described as being "lost in thought." Guthrie also used many anecdotes to illustrate his concepts:

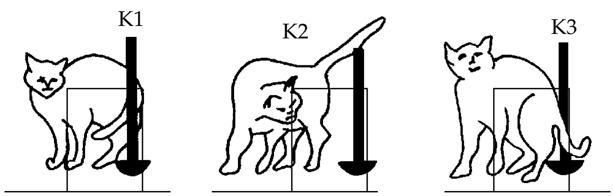
> In a Pacific coast city recently a number of dogs succumbed to strychnine poisoning. Poisoned chunks of beef were found in the neighborhood. Several owners of good dogs undertook to train their animals not to indulge in stray tidbits by scattering many pieces of beef to which were fastened small mousetraps of the familiar spring variety. (Guthrie, 1935, p. 21)

The dogs quickly developed a "very supercilious attitude toward stray meat" as a result, Guthrie concluded, of the almost perfect contiguity between eating and the action of the mousetrap (Guthrie, 1935, p. 21).

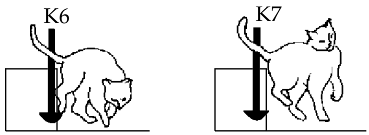
A young mother once asked Guthrie how she could teach her daughter not to throw her coat on the floor when she arrived home. Guthrie advised her to insist that the girl put her coat back on, go out the door, return, remove her coat, and hang it up. In this way, contiguity between entering the house and hanging up the coat would be preserved and the habit would be established. The mother reported success with this procedure. Guthrie also reported the example of "two small countryboys who lived before the day of the rural use of motor cars and had their Friday afternoons made dreary by the regular visit of their pastor, whose horse they were supposed to unharness, groom, feed, and water and then harness again before the pastor's departure" (Guthrie, 1935, p. 48). To preserve their afternoons, the two boys retrained the horse. One of them stood behind the animal and shouted "Whoa," whereupon the other boy gave the horse a sharp jab with a hayfork. Guthrie reported that the boys were "quite satisfied with the results." When the pastor said "Whoa," the horse would lunge forward, and the boys were able to enjoy their Friday afternoons undisturbed by the pastor's visit (Guthrie, 1935, p. 48). Guthrie also described how nervous bird dogs can be trained by discharging a pistol at a great distance, slowly moving closer, and then using a louder pistol. He also listed different methods of "breaking horses." One method, favored by the military, is to train the horse first with a light blanket, then with a sack, then with a sack with a little sand, and then with more sand until the horse carries a saddle and finally a rider. In all these cases, movements are associated with stimuli through contiguity. Guthrie considered the habit of smoking to be made up of many movements. Many stimuli have become signals to smoke: the sight and smell of tobacco, finishing a meal, and sitting down to work, among others. For a person to stop smoking, these stimuli must be associated with new movements. The habits might be sidetracked by, for example, eating an apple after dinner or chewing gum while working (Guthrie, 1935, chapter XI).

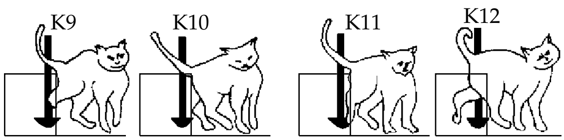
Descriptive phrases, stories, and anecdotes have an undeniable charm but are no substitute for experimental results. Guthrie was well aware of this deficiency and on one occasion set out to remedy it. From the autumn of 1936 to the spring of 1939, Guthrie and his colleague, George P. Horton, conducted an intensive study of contiguity learning in cats. At the time, Guthrie was 50 years of age and had numerous administrative responsibilities, but he spent his late afternoons in the department of psychology's vivarium taking notes while Horton tested their cats. They first presented their results in a film distributed through the Psychological Cinema Register in 1938 and then in their monograph "Cats in a Puzzle Box," published in 1946. As the title implies, they used a puzzle box and recorded approximately 800 escape responses. A conspicuous feature of their apparatus was a slender vertical rod or pole about one foot away from the front of the box. When the cat jostled or rubbed against the pole, the front door opened and the cat escaped. The moment the rod moved, a camera photographed the cat, thus making a permanent record of the cat's behavior at the moment of escape. Once they had set up this apparatus, they were able to ask: "Does the behavior of the cat in the puzzle box go at any point contrary to, or in violation of, the principle of association through contiguity?" (Guthrie & Horton, 1946, p. 1).

Since the box opened as soon as the pole moved, the principle of contiguity predicted that the cats would learn a specific movement, captured by the camera. Any given cat should show considerable stereotypy in its behavior from trial to trial. Individual cats' responses at the moment of release were indeed highly stereotyped, as illustrated by cat K:



On its first trial, it struck the pole while turning in the box after some 4 seconds. This was repeated after 13 and 17 seconds on the next two trials. In the fourth trial, the cat repeated the movement, but the mechanism failed to operate and the cat walked around the pole, striking it with its left shoulder. On trial 5, the first turning movement failed to operate the mechanism, and the cat kept on turning, striking the pole with its rear foot. In trials 6, 7, 9, 10, 11, and 12, the same turning response brought release (Guthrie & Horton, 1946, p. 27).





Later responses of this and other cats included rubbing against the pole and leaning into it while walking past. The cats had learned responses contiguous with escape from the box.

In 1979, Bruce Moore and Susan Stuttard suggested that the stereotyped responses Guthrie and Horton had observed might in fact have been part of the cats' species-typical greeting for human observers, a rubbing or brushing response that the cats redirected to the post in the box. In a replication of the earlier experiment, they found that cats approached and rubbed the post when they could see human observers but did not do so when the observers were hidden. Guthrie's explanation might have been incorrect, but his experiment remains a classic study of animal learning.

Guthrie's Clinical Interests

In 1938, Guthrie published *The Psychology of Human Conflict*, a reflection of his long-standing interest in clinical psychology. He had read and studied the works of Sigmund Freud as a graduate student and had taught a course on the psychology of adjustment for many years. With his wife, he translated Pierre Janet's *Principles of Psychotherapy* (1903) in 1924. He found Janet's views, especially his conception of the unconscious, much more appealing than Freud's "appeal to darkness" (Guthrie, 1948, p. 65). He also preferred Janet's notion of a *force mentale* to what he considered Freud's pseudophysiological explanations. Janet believed that this mental force differs in strength in different people and also waxes and wanes at different times. When it is exhausted through a series of life crises, neurotic symptoms are likely to develop. If the *force mentale* can be restored, neurotic symptoms will be alleviated. Janet's conception of humans as delicately balanced energy systems appealed to Guthrie. In 1903, Janet had published the first detailed descriptions of bulimia (Pope, Hudson, & Mialet, 1985). After Janet's death, Guthrie stated that his contribution to psychology had been greater than Wundt's and criticized psychologists for ignoring his work (Guthrie, 1948).

During World War II, Guthrie served as a civilian consultant in military intelligence and in the Office of War Information. In 1945, he was elected president of the APA. After the war he returned to the University of Washington and devoted most of his time to administrative duties. However, he did find time to coauthor *Educational Psychology* (1950) and to write *The State University: Its Function and Future* (1959). In 1958, the American Psychological Foundation awarded him a gold medal for his contributions to psychology. Guthrie died of a heart attack in 1959 at the age of 73 and was remembered as "a witty and warmhearted sage, who was not only wise but always ready with an apt way of phrasing his wisdom" (Sheffield, 1959, p. 642).

CLARK LEONARD HULL (1884–1952)

Hull's Early Life

Clark Leonard Hull was born on a farm near Akron, New York, in May 1884. He attended a one-room rural school, took all the courses it offered, taught there for a year, and then entered Alma Academy. Even as a young boy, Hull had a strong drive to succeed, to do well and be something more than "an obscure chore boy," as he was when he took odd jobs to earn his way through high school. Hull's diaries of those years contain frequent references to long periods of work and study and to his intense desire to succeed. This entry from May 2, 1903, is typical:

> Worked all day. Got poor marks in Latin for three months. I have made up my mind that I will get 92 or more next month. I am going to work on that til I bust if I don't. Am going to commence tonight. This will be a test as to whether I have got the power to meet formidable obstacles. 92 or bust. I've done it once and I can do it again. (Hull, 1962, p. 811)

His dedication and high level of aspiration had their price. Hull was intensely self-critical, and after taking the Latin test he felt great disappointment because his score was "only 91.5." Financial pressures forced him to interrupt his high school education and work for a year as an apprentice mining engineer in Hibbing, Minnesota. He returned to Alma Academy and graduated, but then suffered a severe bout of typhoid fever which left him physically weak and delayed his entrance to college for a year.

Clark L. Hull.
(Archives of the History of American Psychology, University of Akron)

At Alma College, Hull studied mining engineering, but a severe attack of poliomyelitis at the end of his second year left one leg paralyzed and ruled out a career as a mining engineer. Hull decided to study either religion or psychology, finally choosing psychology because he felt it would allow both theoretical and practical work with apparatus. To save money for his education, Hull taught in a high school for two years after his illness before he entered the University of Michigan to complete his undergraduate studies. At 27 years old, recently married and having overcome serious difficulties, Hull was more mature and dedicated, but also more shy and reserved, than the average student. He ascribed these characteristics to his strong desire to overcome the effects of polio and to show the world that though he was a man "who walked with a cane," he was as good as anyone.

At Michigan, Hull's interests turned more and more toward psychology. He graduated with a B.A. degree in 1913 and again taught for a year, this time at a normal school[3] in Kentucky, to save money for graduate school. He was admitted to the University of Wisconsin as a graduate student and was assigned as a research assistant to Joseph Jastrow. Jastrow had taken his Ph.D. with G. Stanley Hall (Chapter 9) and was an active experimental psychologist. However, in selecting his graduate students, Jastrow often chose talented ironworkers and engineers; with their assistance, he added an exotic Moorish room to his house (Meyer, 1978). Thus Hull's background might have had something to do with his appointment. In any event, Hull was delighted to have this position, for his journey to graduate school had been long and

[3] *normal school,* n. A school giving a two-year course to high school graduates training to be teachers (RHDEL, p. 983).

arduous. Persistence, perseverance, and stick-to-itiveness characterized Hull all his life (Spence, 1952).

At Wisconsin, Hull's commitment to psychology, especially to experimental psychology, became firm. In 1916 he wrote in his diary:

> It seems almost certain now that I shall be a pure psychologist, and that my career will be spent in the free atmosphere of a great university. That this is settled is a very great advantage, for now I shall not need to waste energy preparing for work I shall never do. (Hull, 1962, p. 814)

In his dissertation research, Hull used complex Chinese characters to which subjects learned specific responses. His dissertation, "Quantitative Aspects of the Evolution of Concepts," which demonstrated the development and use of concepts, came to be quoted extensively in the psychological literature. Hull was recognized as a creative and imaginative experimenter. He received a Ph.D. degree in 1918, when he was 34 years old, and then accepted a position as an instructor at Wisconsin.

Hull's Research on Aptitude Testing

Almost immediately, Hull began the first of three distinct phases of his research career, his work on aptitude testing. At Wisconsin he was assigned to teach a course on psychological testing. Knowing almost nothing about the topic, he read the literature on testing and was struck by what he considered the poverty of the field and especially by the weakness of attempts to validate different aptitude tests. In his characteristically thorough manner, Hull set out to develop a scientific body of knowledge on aptitude testing and even to develop a "universal aptitude test." Later he realized that the latter goal was unrealistic, but his work in this area did lead to his first book, *Aptitude Testing,* published in 1928.

In his attempt to validate various tests, Hull made extensive use of correlations between test scores and performance. The tedium of computing correlation coefficients with tables and by hand led Hull to build a correlation machine that would compute such correlations automatically. He was an accomplished tinkerer, gadgeteer, and mechanic who liked to design and build machines. A punched paper input provided data to the machine, which could be programmed to do correlations and other operations. While many people doubted that such a machine could be designed or would ever work, Hull's machine did calculate correlations. Today, when we daily use handheld electronic calculators and desktop computers, Hull's achievement may not seem great. However, at the time it was a considerable achievement, and Hull's machine is now housed in the Smithsonian Museum in Washington, D.C. His book on aptitude testing was well-received, but Hull concluded that a large-scale study with thousands of workers was needed. While such a study might be possible in a large city, it was not feasible in Madison, Wisconsin, so Hull decided to end his work on aptitude testing. He turned to his second major research interest, hypnosis and suggestibility. Hull studied hypnosis first at Wisconsin and then at Yale after his move to that university in 1929.

Hull's Research on Hypnosis and Suggestibility

Once again this interest developed from a course Hull taught. In lectures to premedical students, Hull discussed hypnosis and found that his students were fascinated. He became interested in hypnosis and especially in the role suggestibility plays in medical cures. Jastrow, too, was interested in hypnosis, for he had often investigated psychical phenomena. An avowed skeptic, Jastrow delighted in exposing as charlatans and frauds the seers, soothsayers, psychics, clairvoyants, and fortune tellers who visited Madison. Hull attended a séance and was impressed by the ardor and enthusiasm of the participants and the intensity of their belief that they had communicated with the "other side." However, true to his mentor Jastrow, Hull concluded that the whole thing was based on trickery and suggestion.

After reviewing the literature on hypnosis (Chapter 8), Hull concluded that this field, too, was in a "dilapidated state" (Hull, 1933, p. ix) and in dire need of objective experimental investigations. He began his research hoping to conduct "one hundred or at least ninety-nine systematic, empirical studies," and he did publish thirty-two papers and one book on hypnosis (Hull, 1933, Preface). Hull was well aware of the dangers and pitfalls of studying hypnosis and of the many earlier cases of error, deception, and even fraud (Chapter 11). He was determined to avoid the "wretched experiments" (Hull, 1933, p. 16) of the past and was successful in doing so. Hull described his results and theoretical views on hypnosis in his second book, *Hypnosis and Suggestibility: An Experimental Approach*, published in 1933. He described hypnotic phenomena and experiments in which instruments were used to record physiological responses during the hypnotic trance and outlined techniques such as fixation and direct suggestion that were used to induce a hypnotic trance. Hull believed that susceptibility to hypnosis, rather than being characteristic of certain people, is a trait that has a normal distribution in the population as a whole. His research showed that women and girls were only slightly more susceptible to hypnosis than men and boys. Children were somewhat more susceptible than adults. In general, normal people of average intelligence made the best subjects for experiments on hypnosis. Hull found little evidence of a relationship between high and low intelligence, various character traits, neuroses, or psychoses and susceptibility to hypnosis. He concluded that hypnotic susceptibility was less special and restricted than earlier psychologists had thought.

Hull also found that hypnosis did not facilitate the recall of recent memories. Subjects were no more likely to recall the details of a recent event under hypnosis than they were in a normal, waking state. However, he did find that hypnosis allowed subjects to recall some childhood and other old memories. Posthypnotic suggestions, a favorite demonstration of stage hypnotists, were found to be relatively ineffective. Hull concluded that hypnosis is best described as a state of hypersuggestibility.

The most important characteristic of all these conclusions was that they were based on objective, experimental evidence. When *Hypnosis and Suggestibility* was published, reviewers praised Hull's scientific approach and the manner in which he had opened hypnosis and suggestibility to experimental investigation. Nearly thirty years later, Hilgard, a leading contemporary investigator of hypnosis, said of Hull's book, "It still stands as a model of clarity and objectivity in the approach to what remain even today puzzling and unresolved problems" (Hilgard, 1961, p. xv). Nearly sixty years after the book's publication, Roger Page concluded:

> To sum things up, Hull's pioneering work deserves considerable recognition not only for placing the study of hypnosis on a solid foundation but also for contributing in many ways to our present understanding of hypnosis. (Page, 1992, p. 183)

Today, *Hypnosis and Suggestibility* is still used as a text in university courses on hypnosis. Despite its excellence, Hull's research did have one unfortunate consequence. A woman who had been hypnotized sued Hull and Yale University, where the experiment had been done, claiming that the experience had caused her to have a mental breakdown. The suit was settled out of court, but the university authorities instructed Hull to end his research on hypnosis.

Hull's Behavior System

While Hull's work on aptitude testing and hypnosis was of undeniable importance, his most significant contribution to psychology was his attempt to develop a comprehensive behavior system. This third phase of his research career began at Wisconsin and continued after his move to Yale in 1929. James Angell (Chapter 10), the president of Yale, recruited Hull to strengthen Yale's Institute of Psychology, which soon became the Institute of Human Relations. When he moved from Wisconsin, Hull confided in his diary that he had "torn myself from the associations of fifteen years, to make a new start in my scientific life" (Hull, 1962, p. 826).

At Yale, Hull began to think seriously about writing a behavioristic account of psychology. In the summer of 1930, Hull was invited to lecture on aptitude testing at Harvard, where he acquired copies of Isaac Newton's *Principia* and Bertrand Russell and Alfred North Whitehead's *Principia Mathematica.* Unlike Guthrie, Hull found these works to be a model for the type of psychological system he hoped to develop. Returning to Yale, he began a serious study of the works of the classical epistemologists and philosophers; Democritus (Chapter 1), Thomas Hobbes, John Locke, David Hume, Immanuel Kant, and Gottfried Wilhelm von Leibnitz (Chapter 2). At the time, Hull was in his 40s, a professor at Yale and a man with a secure reputation in psychology; yet, rather than resting on his laurels, he began this study, a long and demanding series of experimental investigations, and work on the behavior system that filled the rest of his life. Hull was often troubled by forebodings of early death and the feeling that there was not sufficient time to accomplish what he wanted to do. He was convinced that after the age of 50 he would no longer be able to make the contributions to psychology he expected. His conviction that time was running out motivated his compulsive drive to work and produce.

Hull was sympathetic to John Watson's *behaviorism* and agreed that psychology should be the science of behavior. He had also been impressed with Ivan Pavlov's *Conditioned Reflexes* (1927; Chapter 12) and found Pavlov's experiments admirable for the care with which they were conducted and the precision of their results. A third influence came from Robert Woodworth's (1918) imposition of the organism (O) between the stimulus (S) and the response (R), forming S–O–R (Chapter 10). One of Hull's most influential students, Kenneth Spence, described Hull's system as a "Herculean elaboration of this S–O–R formula" (Spence, 1952, p. 646).

Hull's first major theoretical paper on learning was published in 1929. In "A Functional Interpretation of the Conditioned Reflex," Hull described the conditioned reflex as "an automatic trial-and-error mechanism which mediates blindly and beautifully, the adjustment of the organism to a complex environment" (Hull, 1929, p. 498). With his engineering background and fascination with machines and gadgets, Hull was intrigued by the notion of the human organism as a machine. In *Principles of Behavior* (1943), he recommended as "a prophylaxis against anthropomorphic subjectivism" the device of regarding "from time to time, the behaving organism as a completely self-maintaining robot, constructed of materials as unlike ourselves as may be" (Hull, 1943, p. 27). Hull hoped that one day he would be able to design and build a behaving machine that would match the success of his correlation machine. He was never able to do so, but this mechanistic view of behavior permeated his behavior system. Hull saw the conditioned reflex as a mechanism that allows an organism to react to environmental demands. He tried to extend the principles of classical conditioning to instrumental and trial-and-error learning situations, that is, to construct a single-factor theory of learning. He found this extension difficult; after rereading Thorndike, he concluded it was impossible. Instead he accepted the principle of reinforcement based on drive reduction, which had developed from studies of instrumental conditioning, as a second major factor in learning. From then on, Hull became a law-of-effect or reinforcement theorist, though he still employed Pavlovian concepts.

In 1936, Hull was elected president of the APA. For his presidential address he planned originally to present a "Prospectus for Psychology Based Upon Habit." Instead, he entitled the address "Mind, Mechanism, and Adaptive Behavior" and presented for the first time to a general audience of psychologists his organized, deductive behavior system (Hull, 1937). Hull believed that a sound general theory of behavior was vital to psychology. He was convinced that the most effective way for psychology to progress as an experimental science was to shape a well-developed theory that would serve as a framework for research. Such a theory would not only integrate and organize experimental results, it would also indicate directions for future research. It would serve as the *Principia* of psychology. As his model, Hull used theoretical systems employing a set of explicitly defined postulates from which an experimenter could deduce and test certain theorems through experimentation. Such systems had worked well in physics. Hull described himself as being "docile to the data" and saw the need for constant revision of the behavior system as its predictions were tested and either confirmed or refuted. He considered his behavior system only a first step, but it was the most ambitious attempt to construct a formal behavior system that we have encountered.

Hull's Learning Theory

As part of his presidential address, Hull prepared and distributed a set of mimeographed sheets containing his first set of postulates, definitions, and derived theorems. Each derivation ended with the Q.E.D.[4] of mathematical proofs, an indication of the rigor with which Hull hoped to proceed. This system was further extended and developed in his most important book, *Principles of Behavior,* published in 1943. *Principles* represents Hull at his most readable, and for more than two decades it was one of the most frequently cited and quoted works in psychology. The book sold consistently from its publication to the mid-1960s, with its peak sales coming in 1949. From 1946 until his death in 1952, Hull's health deteriorated and he suffered increasingly frequent and severe attacks of chest pain. Still, during those six years, he was able to write *Essentials of Behavior* (1951) and *A Behavior System,* published posthumously (1952a).

Hull's final system consisted of seventeen postulates and seventeen corollaries. The central postulate related the strength of a habit (S^HR) to the number of times the habit was reinforced (N):

> Habit strength, the tendency of a stimulus trace to evoke an associated response, increases as a positive growth function of the number of trials, provided that trials are evenly spaced, reinforcement occurs on every trial, and everything else remains constant. (Paraphrased from Hull, 1943, p. 114, in Hilgard, 1956, p. 131)

Successive reinforcements contributed increments of "habs" to habit strength. However, habit strength is an intervening variable in Hull's system and cannot be measured directly. It combines with other intervening variables relating to drive level (D), stimulus intensity (V), and the incentive value of the reward (K) in a multiplicative function to yield a value for the reaction potential (S^ER):

$$S^ER = S^HR \times D \times V \times K$$

S^ER then combines with other intervening variables S^OR and L to determine the value of the dependent output variables—reaction latency, reaction amplitude, and number of nonreinforced responses before extinction.

Other Hullian postulates relate habit strength to the nature and amount of the reinforcing agent, the time between response and reinforcement, and the temporal relationship between CS and CR. Hull showed that theorems could be derived from each of these postulates and then tested experimentally. The business of psychology was to analyze the interactions between the system's variables in situations that were as simple as possible. Hull intended his system to be as general as possible, that is, one that would be successful in pre-

[4] *Q.E.D.,* n. Latin *quod erat demonstrandum*—that which was to be shown or demonstrated (used especially in mathematical proofs) (RHDEL, p. 1173).

dicting both the amplitude of the galvanic skin response in humans and lever pressing by rats. He led an extensive program of experimental research on classical and instrumental conditioning using both human and animal subjects. Hull was open to critical tests of his system, though he did like to wager malted milks on their outcome. One of his former students, Carl Hovland, remembered that Hull had

> An unusual knack for getting his students so involved with their research problems that they continued related investigations when they took jobs at other institutions, and soon had students of their own carrying on similar research. There was a large number of enthusiastic fourth- and fifth-generation students throughout the country. (Hovland, 1952, p. 349)

These students used a psychological language of their own, and even today it is not unusual to hear references to "subscript S, superscript H, subscript R" and the multiplicative effects of "big D" in their discussions. Hull also attracted students from a number of foreign countries, especially Japan. The Japanese students took degrees with Hull at Yale, returned to Japan, and established a Hullian school of Japanese psychology. One result was that in the 1950s and early 1960s, Japanese journals of psychology contained numerous "Hullian" articles reporting experimental investigations of the interactions between "Hullian" variables. When all else failed, Hull ruefully admitted that he would often make an especially definite prediction that would immediately send a dozen people rushing to their laboratories to prove him wrong.

Hull's System: An Evaluation

Hull's was clearly an ambitious and sophisticated attempt to develop a general system of behavior, but was it a success? Certainly it was in terms of its heuristic value in stimulating research. In his obituary for Hull, Kenneth Spence pointed out that from 1941 to 1950, approximately 40 percent of all experimental reports in the *Journal of Experimental Psychology* and the *Journal of Comparative and Physiological Psychology*, two prestigious APA journals, made reference to Hull (Spence, 1952, p. 641). In the areas of learning and motivation, Spence found the citations rose to 70 percent, more than twice the number of any other behavior theorist. Similarly, Harry Ruja (1956) tallied citation frequencies for psychologists in three major journals of experimental psychology from 1949 to 1952. Hull was by far the most frequently cited psychologist, followed by Spence, Hovland, Hilgard, and Neal Miller, all Hull's former students or close collaborators. Hull's behavior system and theory of learning clearly had a great impact.

However, Hull was not without his critics. On the one hand, some questioned the limited range of experimental situations Hull used, claiming that they could not possibly form the basis of a general system or theory of behavior. In Hull's defense, he used the best available materials in developing his system, whatever their source and no matter what their limits. Thus, postulate II refers to eyelid conditioning, postulate X to the conditioned galvanic skin response, postulate IV to rats' bar pressing and the amplitude of the galvanic skin response, postulate VII to rats' running responses, and so on.

A second criticism concerns the artificial and limited situations Hull used to test his system. How could a psychologist who did not study people in situations outside the laboratory hope to develop a general system of behavior? Such critics, Hull maintained, misunderstood the process of science. Just as physicists use the unworldly and artificial conditions of the vacuum chamber and biologists the controlled environment of a test tube, psychologists who study behavior must begin with artificial, controlled situations. Hull hoped to go on to more complex learning situations and eventually to a broad range of human problems. He was never able to do so, though his students John Dollard and Neal Miller made one such attempt. In 1950, they published *Personality and Psychotherapy,* in which they tried to integrate Freud's psychoanalysis with Hull's learning theory. They treated the Freudian concept of transference as a case of stimulus generalization, repressed conflicts as those the patient is unable to label, and maladjustments as the result of conflicts between incompatible habits and drives.

Other critics contended that while Hull's system had scored impressive successes in predicting the behavior of groups of rats, it was far from successful in predicting the behavior of individual animals. Consider postulate IV, based on rats' bar pressing and the amplitude of the galvanic skin response. Hull's derived theoretical curve for the growth of habit strength with successive reinforcements corresponded well to the reports of Stanley Williams (1938) and C. Theodore Perin (1942). Their results showed that groups of rats given increasing numbers of reinforcements for lever pressing make increasing numbers of extinction responses. However, when one considers the behavior of individual animals in these experiments, Williams's results show that the two animals making the largest number of extinction responses were actually in the group given the smallest number of reinforcements (Williams, 1938, p. 512); four rats given the largest number of reinforcements actually made the smallest number of extinction responses. Similarly, in Perin's results, the two rats making the largest number of extinction responses were in the group receiving only thirty reinforcements, while three animals in the group receiving seventy reinforcements did not make a single extinction response (Perin, 1942, p. 99). While Hull's theory was successful in predicting the behavior of groups of animals, it was less useful in predicting the behavior of individuals.

Finally, there were psychologists, with B. F. Skinner in the forefront, who questioned the possibility and even the utility of a general system of behavior. Skinner's position will be considered in more detail later in this chapter.

The rise and fall of Hull's theory in terms of influence is evident from citation counts of papers in the *Journal of Experimental Psychology* making reference to Hull and to his most prominent student, Kenneth Spence (Guttman, 1977, p. 321).

Year	Percentage
1940	4%
1950	39%
1960	24%
1970	4%

What, then, can we conclude about Hull's behavior system? Perhaps it was a magnificent failure—magnificent in its ambition and the rigorous program of experimental research it stimulated, but a failure in that the goal of a comprehensive behavior system was not achieved and may in fact be impossible. The days of ambitious theories such as Hull's have passed. Perhaps a magnificent failure is too harsh a judgment; a fairer evaluation might be that of Hilgard, who wrote of Hull:

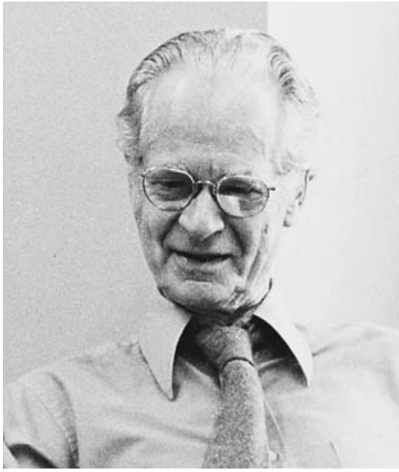
> It must be acknowledged that Hull's system, for its time, was the best there was—not necessarily the one nearest to psychological reality, not necessarily the one whose generalizations were the most likely to endure—but the one worked out in the greatest detail, with the most conscientious effort to be quantitative throughout and at all points closely in touch with empirical tests. (Hilgard, 1956, p. 182)

Hull's contributions were recognized by his contemporaries. In addition to attaining the presidency of the APA, he was elected to the National Academy of Sciences in 1936 and in 1945 received the Warren Medal from the Society of Experimental Psychologists in recognition of his "careful development of a systematic theory of behavior."

Hull died of a heart attack in May 1952, just weeks before he was to retire from Yale University. He had been hard at work on his behavior system until shortly before his final illness.

BURRHUS FREDERIC SKINNER (1904–1990)

For more than three decades, from 1945 to 1975, B. F. Skinner was the best-known psychologist in the world. In 1970, a random sample of 1,000 APA members ranked Skinner as the most important influence on contemporary psychology (Wright, 1970). That same year, another poll included Skinner among the "100 most important people in the world today" (Robinson, 1970). A 1971 Johns Hopkins University survey of psychology faculties and graduate students found Skinner was the social scientist whose work they most respected. Hilgard wrote, "There is little doubt that B. F. Skinner, or Fred, as his friends knew him, became widely influential and certainly the best-known American psychologist of his generation" (Hilgard, 1996, p. ix). Rae Goodell (1975) surveyed college students' recognition of the names of scientists: 82 percent of the students correctly identified Skinner, who ranked highest of any scientist, outranking such luminaries as Margaret Mead (81 percent), Jonas Salk (78 percent), Linus Pauling (50 percent), and James D. Watson (15 percent). Eugene Garfield (1978) found Skinner was one of the most frequently cited authors in the social sciences. In addition to Skinner's own extensive writings—twelve major books, numerous papers, and a multivolume autobiography—there are extensive writings about him, some favorable (Evans, 1968; Wiener, 1996), some unfavorable (Machan, 1974), and some falling between (Carpenter, 1974). Finally, there are three journals devoted to a Skinnerian approach to psychology: the *Journal of the Experimental Analysis of Behavior*, founded in 1958 and having the largest circulation of any journal



B. F. Skinner.
(James R. Holland/Stock, Boston)

devoted to the study of learning; the *Journal of Applied Behavior Analysis,* first published in 1968 and the second most widely read journal devoted to applications of psychology (Laties, 1987; Lattal, 1992); and the *Behavior Analyst,* the journal of the Association of Behavior Analysts.

As the modern spokesperson for *radical behaviorism,* Skinner became well-known through his popular books and writings, appearances on television talk shows and programs such as *Nova,* public lectures, debates, and discussions. He was an articulate, effective, and at times humorous defender of his position. Skinner, labeled a "benign anarchist" by one of his biographers (Wiener, 1996), was opinionated and controversial: "I now present the devil," said a Harvard professor introducing Skinner to his class as a guest lecturer in the late 1940s (Gerow, 1988, p. 73). On his first television appearance, the interviewer posed Montaigne's hypothetical dilemma to Skinner: "Would you, if you had to choose, burn your children or your books?" His answer was that he would burn his children because he believed "his contribution to the future would be greater through his work than through his genes." This reply provoked the predictably outraged response, much controversy, and many invitations for future appearances. It also prompted this wry comment from one of his two daughters, Julie S. Vargas, herself a psychologist: "Skinner fathered behavior analysis and me. I'm not sure which he considers the greater contribution" (Vargas, 1984). After the publication of his 1971 book *Beyond Freedom and Dignity,* Skinner was described by the then vice-president of the United States, Spiro T. Agnew, as an "extreme radical attacking the very precepts upon which American society is based and an advocate of radical surgery on the national psyche" (Hall, 1972, p. 68). Theologian Richard L. Rubenstein described the same book as "less likely to be a blueprint for the Golden Age than for the theory and practice of hell" (Rubenstein, 1971, p. 53). Skinner estimated that 80 percent of the reviews of *Beyond Freedom* were unfavorable. In September

1971, Skinner reached the pinnacle as a media figure when he appeared on the cover of *Time* magazine. *Time's* headline, "B. F. Skinner Says We Can't Afford Freedom," was calculated to cause controversy, and it did (Skinner, 1971a). Fortunately, Skinner survived the fame and notoriety; as he said in a 1972 interview, "My hat still fits" (Hall, 1972, p. 68).

Skinner's Early Life

Skinner was born in Susquehanna, Pennsylvania, on March 20, 1904. In his autobiography, Skinner gave a detailed, fascinating behaviorist account of his early years. His father, William Skinner, was a small-town lawyer who aspired to political office. His conservative Republican politics did not appeal to the working-class voters of Susquehanna, and he lost all of his election campaigns. His mother devoted her life to her family and to community service. Skinner had one young brother who died at the age of 16. Skinner attended Hamilton College in upstate New York, hoping to become a writer and poet. He took only one course in psychology, taught by William Squires, who had taken his doctorate with Wundt at Leipzig. The only thing Skinner remembered from the course was Squires's demonstration of the two-point discrimination threshold. Skinner graduated in 1926 with *Phi Beta Kappa* honors. As an undergraduate, he wrote regularly for student publications, sometimes under the pen name of Sir Burrhus de Beerus. At a writer's conference, he met Carl Sandburg and Robert Frost. Frost offered to read his work, and Skinner sent him three serious short stories. Frost replied with a warm, supportive letter commenting on Skinner's "niceties of observation" and ending, "You are worth twice anyone else I have seen in prose this year" (Skinner, 1976, p. 249). Such praise strongly reinforced Skinner's ambition to be a writer, and he resolved to spend the year after his graduation testing his skills. He did all the correct things—built a "writer's study," subscribed to literary magazines, read the great books, and even smoked a pipe—but to no avail. At the end of this "dark year," Skinner concluded he had nothing to say and changed his career plans.

Watson's *Behaviorism* had just been published and was being reviewed in the literary magazines Skinner received. In *Dial,* Bertrand Russell described the book as "massively impressive" (Russell, 1927, in Skinner, 1979, p. 10); in 1927, he said of Watson's approach in his *Outline of Philosophy,* "I think it contains more truth than most people suppose, and I regard it as desirable to develop the behaviorist method to the fullest possible extent" (Russell, 1927, in Russell, 1960, p. 73). Later Russell was to change his opinion of Watson's behaviorism (Russell, 1951), but at the time his praise was convincing to Skinner, for Russell had long been his favorite philosopher. The study of behavior appealed to Skinner, who had enjoyed observing the behavior of animals in the Susquehanna countryside and of people in the town itself. Perhaps the study of behavior would provide a career. Skinner purchased copies of Watson's book and Russell's works of philosophy. He read all of Watson and some of Russell, but not the last third, in which Russell undertook to refute behaviorism. Many years later, Skinner thanked Russell for introducing him in his review and philosophy to behaviorism. "Good heavens," Russell replied, "I thought they had demolished behaviorism" (Skinner, 1976, p. 224).

At about the same time as Russell reviewed Watson's book, H. G. Wells reviewed Ivan Pavloff's (*sic*) *Conditioned Reflexes* in the *New York Times.* He characterized the book as "difficult to read, but momentous" and said it provided a clear conception of the workings of the brain. Skinner read Pavlov's book and decided his future lay in psychology, especially in studying conditioning. He applied for admission to Harvard University and was accepted. However, before enrolling as a graduate student, Skinner had one more brief fling at the life of an artist, living for a time in Greenwich Village and Paris. But then it was on to Harvard and the beginning of his career as a psychologist.

Skinner's Training in Psychology

Skinner found most of his Harvard courses dull, uninteresting, and incompatible with his developing interest in behavior. Titchener's former student Edwin G. Boring was director of the Harvard laboratory. Skinner found structuralist psychology especially tedious in Boring's lectures and books. He could not accept Boring's refusal to recognize the possibility of a science of behavior and later recalled reading Boring's *Physical Dimensions of Consciousness* to spur himself on to greater efforts. Skinner found more reinforcement in two places: first, in a seminar with Walter S. Hunter, a Chicago Ph.D. who had worked with Watson, in which he discussed his delayed reaction experiments on animal memory; and second, in courses in the department of biology with W. J. Crozier. Crozier had been a student of Jacques Loeb (Chapter 12), whose book on *tropisms* Skinner had read. Skinner worked in Crozier's laboratory. His first published research was on ants traveling up a slanted surface—a *negative geotropism.* Two other aspects of Skinner's student days at Harvard proved to be of great importance. First, he met Fred S. Keller, and they became friends and lifelong colleagues. Second, in 1929, the International Congress of Physiology was held at the Harvard Medical School. Skinner heard Pavlov's address, which he found impressive. He also obtained an autographed portrait of Pavlov, which he hung above his desk.

During his eight years at Harvard, first as a graduate student, then as a postdoctoral fellow, and finally from 1933 to 1936 as a junior fellow in Harvard's prestigious Society of Fellows, Skinner established and developed his approach to the study of behavior and became more and more an avowed behaviorist. For his dissertation, Skinner undertook to identify a unit of behavioral analysis. Influenced by both Ivan Pavlov and Charles Sherrington, he identified the reflex as that unit. He described the task of psychology as dividing behavior into reflexes and devising measures of their strength and of the variables that affect them. Crozier, the head of the biology department, was the chair of Skinner's dissertation committee, though Boring formally held that position. Boring objected to Skinner's ahistorical approach to psychology, what he considered the poor quality of Skinner's writing, his superficial arguments and flowery language. Skinner resisted, and the result was an extended, intellectual joust between the two of them (Coleman, 1985). Skinner's self-confidence, some would say arrogance, is remarkable. When Gordon Allport asked him during his dissertation examination to outline some objections to behaviorism, Skinner refused to acknowledge even one (Skinner, 1979, p. 75). Nevertheless, he passed the oral examination and received his Ph.D. degree in 1931.

Skinner's Operant Conditioning

At Harvard, Skinner developed the apparatus that most psychologists, following the lead of Hull and his students, refer to as the "Skinner box"[5] but which Skinner himself always called an "operant conditioning apparatus." In Skinner's early experiments, a hungry animal placed in the apparatus, first a rat and later a pigeon, makes an arbitrary response—in the rat's case, pressing a lever; in the pigeon's, pecking an illuminated disk or key—and is reinforced for doing so. The rat or pigeon makes the response, food is delivered, and the probability of the response increases. The animal *operates* on its environment to produce a food reward; hence the term *operant conditioning,* first coined by Keller and later adopted by Skinner.

Skinner's procedure had some similarities to Thorndike's *instrumental conditioning* (Chapter 10), and Skinner has often acknowledged that his contribution was to take Thorndike and the law of effect seriously. Still, there are differences between the two, the most important being that in Thorndike's experiments, both subject and experimenter controlled the response rate, whereas in Skinner's apparatus, the subject held sole control. In Thorndike's instrumental conditioning, the cat's response latency and the inter-trial interval the experimenter selects determine how many responses the cat can make every hour; in Skinner's operant conditioning, the response rate is totally under the animal's control. Response rate quickly became the basic datum of Skinner's operant conditioning experiments.

Skinner's development of the operant conditioning apparatus and his use of the response rate were important steps toward his goal of an experimental analysis of behavior. How did Skinner come to take these steps? In his article "A Case History in Scientific Method" (1956), Skinner described these steps. Originally he set out to study habituation to a novel stimulus by using a running response in young rats. Skinner developed what he termed his "four principles of scientific practice": when you run into something interesting, drop everything else and study it; some ways of doing research are easier than others; some people are lucky; and apparatuses, especially complicated ones, break down—Skinner developed his apparatus through perseverance, good luck, and some accidents. In the apparatus an animal learned right before his eyes, and the response rate reflected that learning.

Skinner then studied extinction. When he disconnected the food dispenser so that lever pressing no longer produced food, the response rate decreased in

[5] *Skinner box,* n. A boxlike testing device used in experiments in animal learning, especially in operant conditioning (RHDEL, p. 1336).

an orderly manner. He could also study spontaneous recovery and reconditioning, as well as the effects of deprivation and satiation. In all cases, changes in response rate were orderly and predictable. Specified operations led to predictable outcomes. Behavior could be predicted and controlled with precision.

In 1936, Skinner joined the faculty of the University of Minnesota at a salary of $1,900, having been highly recommended by Boring. At Minnesota he published his classic *The Behavior of Organisms* in 1938. The publisher, Appleton-Century-Crofts, who already had a contract with Hull for his *Principles,* was initially doubtful about "another rat book" (Skinner, 1979, p. 214). Another difficulty was that Skinner wanted to include more illustrations than the budget allowed. A favorable prepublication review by Tolman, who predicted that the book "will always have a very important place in the history of psychology" (Skinner, 1979, p. 211), and a grant of $500 from Harvard made publication possible. In the book, Skinner described his *operant* system of behavior, in which response consequences are crucial. Responses followed by positive outcomes—for example, the presentation of food to a hungry animal or escape from or avoidance of electric shock—are reinforced, and their response rate increases; responses followed by negative outcomes—such as the removal of food or presentation of shock—are punished, and their response rate decreases. Skinner also described experiments on extinction, spontaneous recovery, reconditioning, discrimination learning, and the effects of drives. In a retrospective review fifty years later, Travis Thompson described *The Behavior of Organisms* as "one of a handful of books that changed the face of modern psychology" (T. Thompson, 1988, p. 397). The research Skinner outlined is an example of what Thomas Kuhn (1970) termed a *paradigm shift.* For the first time, the behavior of individual animals was the subject of intensive, dynamic analysis and control.

Sixty years later, *The Behavior of Organisms* is still a frequently cited work, but in the years following its publication it was not widely read. Most psychologists interested in animal learning were anticipating publication of Hull's "big book," his *Principles of Behavior,* and only 800 copies of *The Behavior of Organisms* were printed. Eighty copies were sold in the first four years. By 1946, only 548 copies had been sold. Some reviews of the book were negative (Wolf, 1939; Finan, 1940). Four main criticisms predominated. First, some critics argued that the title itself, *The Behavior of Organisms,* was inappropriate and even pretentious for a book that dealt exclusively with lever pressing by rats. Second, they accused Skinner of neglecting the works of others on learning and motivation, a criticism that was to a large degree warranted. Third, some reviewers claimed that the book dealt with a restricted, limited, and artificial range of behavior. Fourth, the book lacked the "fortification of statistics" and described the behavior of only a small number of subjects. That criticism, too, was warranted, for statistical analysis did not interest Skinner; his aim was to predict and control the behavior of individual organisms. His view on this issue never changed. In 1984, Skinner acerbically opined that two leading mathematical learning theorists, Bush and Mosteller, had wasted "vast quantities of impeccable mathematics on vast quantities of peccable data" (Skinner, 1984, p. 124). Despite such criticisms, Skinner's contribution was important. He had succeeded in specifying and measuring a functional unit of behavior, the *operant*, which was for Skinner a class of behavior having an orderly relationship to environmental effects.

Schedules of Reinforcement

In the 1940s, Skinner began his research on the effects of different schedules of reinforcement. These experiments proved to be of great importance. They began serendipitously, as Skinner recorded:

> Found myself on a Friday afternoon with only a few pellets on hand and did not want to spend part of the weekend making more. If I reinforced only an occasional response, my supply would last for many days. (Skinner, 1979, p. 97)

Skinner began to reinforce only some of the responses. He found that intermittent reinforcement maintained the frequency of responding; in fact, the animals responded more often than they did when every response produced reinforcement. Skinner and his students went on to conduct a massive program of research on the effects of schedules of reinforcement. Ferster and Skinner described this work in their monumental *Schedules of Reinforcement* (1957), a work containing tens of thousands of records of responses. Such schedules have predictable and reliable effects on response rate and have proved to be a basic tool in the experimental analysis of behavior. The number of lever presses by rats and pecks by pigeons Skinner has inspired is awe-inspiring. Research on schedules has proved to be a major contribution to psychology, and it is the research Skinner himself was most proud of. When asked in 1967 which of his contributions to psychology he would select as most important, Skinner replied that, "It would be the whole question of the contingencies of reinforcement arranged by schedules of reinforcement. . . . I think it is my basic scientific contribution" (Skinner, in Hall, 1967, p. 107).

Behavioral Control

In a paper entitled "How To Teach Animals," published in 1951, Skinner described what he termed *shaping.* When one trains a pigeon to peck a key for food, the bird is reinforced first for looking at the front wall of the chamber, then for moving toward it, then for lifting its head, and finally for pecking. Gradually the pigeon is *shaped* through reinforcement to make the response. Not only key pecking, but also such behaviors as choosing one playing card from a deck or pecking at the keys on a piano, can be shaped. Much as a sculptor molds clay, shaping allows the psychologist to mold behavior.

Shaping is a powerful procedure for establishing and changing behavior, and it surely is no coincidence that Skinner chose to entitle the second volume of his autobiography *The Shaping of a Behaviorist* (1979). Skinner became well-known for his ingenious demonstrations of shaping. At Minnesota, he shaped a rat to drop a marble through a hole. The student newspaper ran a story on the rat, which they named Pliny the Elder, and local newspapers and

Operant Conditioning and the Early Animal Space Flights

Animals trained using the operant conditioning techniques Skinner developed made early flights into space, but not the very first flights (Rohles, 1992). On October 4, 1957, the Russians launched Sputnik I. *Sputnik* is Russian for "fellow traveler." That first satellite was a 23-inches-in-diameter aluminum sphere weighing 184 pounds and carrying two radio transmitters. Their signature "beep-beep" signals could be heard all over the world. Sputnik I orbited the earth fifteen times each day at 18,000 miles an hour for three months. Two years earlier, a panel of psychologists had briefed the National Security Council as to the potentially serious effects of Soviet achievements in space on American public opinion (Launius, 1994, p. 25). At first, the Eisenhower Administration tried to downplay the Russian achievement. President Eisenhower commented that "the Russian satellite did not raise his apprehensions an iota" (Shelton, 1968, p. 54); the Secretary of Defense called Sputnik "a useless hunk of iron"; one of President Eisenhower's assistants asserted that America was not interested in getting caught up "in an outerspace basketball game"; and a White House adviser referred to the Russian satellite as "a silly bauble in the sky" (Halberstam, 1993, pp. 624–625). But the threat to American security and the perceived challenge to Western technological superiority were obvious. Just one month later, the Soviets launched Sputnik II. It was six times bigger and carried a small dog, Laika ("barker" in Russian). Photos transmitted back to earth and broadcast worldwide showed Laika in space. Such an achievement and the apparently rapid progress the Soviet space program was making could not be dismissed. President Eisenhower reportedly sent for his science advisor and asked in anger, "What sort of people would train that dog?" When he learned that they were psychologists, Eisenhower ordered, "Get some psychologists and have them train some American animals!" (Meyer, 1993).

In November 1957, a newly formed Unusual Environments Section was established at Wright Patterson Air Force Base in Dayton, Ohio. That section was headed by a psychologist Frederick H. Rohles, Jr. (Rohles, 1992). The psychologists working in the unit proposed that before American astronauts flew in space, it was essential that animals be subjected to the rigors of space flight. Such test flights would determine whether animals could survive space flight and also whether or not they could perform learned tasks during the flight. At a four-day planning conference in 1958 at the University of Virginia, a delegation of three psychologists—Rohles, Charles Ferster, and Donald R. Meyer, a specialist in primate learning and behavior—recommended doing "a progressive series of experiments starting with extremely simple behavior in mice, progressing through more complicated tasks in monkeys, and culminating in demanding tasks for chimpanzees" (Banghart, 1958, p. 6). Operant conditioning procedures, especially schedules of reinforcement, stimulus control paradigms, and reaction time measures, were to be used.

In the heated competition of the space race between the United States and the Soviet Union, mice were not used and monkeys were trained first. On December 13, 1958, a one-pound squirrel monkey named Gordo made a flight to an altitude of 60 miles; on May 28, 1959, Baker, an 11-ounce female squirrel monkey, and Able, a seven-pound male rhesus monkey, attained an altitude of 300 miles and experienced nine minutes of weightlessness. Both

Operant Conditioning and the Early Animal Space Flights (Continued)

animals were recovered alive after their flight, the first time either space program had achieved such a feat.[6]

In December 1959 and January 1960, two rhesus monkeys, Sam and Miss Sam, made suborbital flights. Those monkeys had been trained to avoid programmed electric shocks by pressing a bar. The monkeys performed their orbital bar pressing throughout lift-off, space flight, and recovery. It was then decided that as part of the Project Mercury Program, chimpanzees would be trained for space flight. Again, psychologists trained in comparative psychology were prominent in training these animals. The chimpanzee Ham made a nineteen-minute suborbital flight on January 31, 1961, bar pressing to avoid programmed shocks. Ham performed well and received only two shocks during the eighteen-minute flight. At a press conference on the morning of Ham's flight, President Kennedy was asked about the flight. Demonstrating his famous wit, he reported, "The chimpanzee who is flying in space took off at 10:18 this morning. He reports that everything is perfect and working well" (Wolfinger, 1994). After recovery from the Atlantic, a helicopter flew Ham's capsule to a recovery ship. When the capsule was opened, Ham was given an apple and orange. When he extended his hand for more fruit, the gesture was widely interpreted as a handshake. A photograph in *Life* and *National Geographic* showing Ham with his arms jauntily folded, waiting to be released from the capsule, proved a propaganda boon for the American space program. After his flight, Ham lived in retirement in the National Zoo in Washington, D.C., where he was a star attraction for many years.

On November 29, 1961, a second operantly conditioned chimpanzee, Enos, made two orbits around the earth. He bar pressed for both food and water on two schedules of reinforcement and solved discrimination problems to avoid shock. His performance was excellent. After splashing down in the ocean, Enos bobbed around in his capsule for some forty minutes before successful recovery. According to a NASA report, when released from his capsule, "Enos jumped for joy and ran around the deck of the recovery ship enthusiastically shaking the hands of his rescuers" (NASA, 1999). The flights by Ham and Enos showed without doubt that primates could survive space flight and perform demanding cognitive tasks. They were important precursors to the space flights of the seven Mercury astronauts and their successors. Looking back on his experience, Rohles wrote:

> The human flights were contingent upon the success of these first animal flights, but more important, they served as landmarks for comparative psychology. Reflecting back on this program, I can only say that Skinner was there. Every technique, schedule, and programming and recording device we used then and subsequently can be traced to him or his students. (Rohles, 1992, p. 1533)

After centuries in which animals had been used in war—pigeons trained to guide missiles and detect enemy installations, dolphins carrying explosives into enemy harbors, dogs used in mine detection and surveillance, the sounds of jungle animals used to detect an enemy's presence (Lubow, 1977)—these monkeys and chimpanzees, trained by psychologists, contributed to the peaceful exploration of space.

[6] The flight of Baker and Able is commemorated in a display in the Smithsonian Air and Space Museum in Washington, D.C.

Life magazine ran features on Skinner's "basketball-playing rat." In another demonstration, Skinner shaped two pigeons to "play table-tennis." The birds stood at either end of a table and vigorously pecked a ball back and forth. The spectacle of two birds "playing table-tennis" intrigued the audience. In his most ambitious demonstration of the power of shaping, *Project Orcon,* Skinner had what he himself referred to as the "crackpot idea" of training pigeons in simulators to act as missile guidance or organic control systems, hence the acronym *Orcon* (organic control) (Skinner, 1960). While the pigeons performed flawlessly in simulators, Skinner was never able to convince the military authorities that their behavior was reliable. Two of his coworkers on Project Orcon, Keller and Marian Breland, were so impressed by the outcome that they founded a company, Animal Behavior Enterprises, to train animals for advertising displays using operant principles. They have had both successes (Breland & Breland, 1951) and failures (Breland & Breland, 1961), but techniques of immediate reinforcement, shaping, and schedule control are now pervasive in training animals in commercial and entertainment settings (Pryor, 1977). After Keller Breland's death in 1965, Marian Breland initiated *operant conditioning workshops,* five-day events divided between lectures on operant principles of behavioral control and the hands-on training of animals (Wiebers, 2002).

In 1945, Skinner left the University of Minnesota for the position of Chairman of the department of psychology at Indiana University. He quickly found that he had neither the talent nor the patience for university administration and gave up the chairmanship after a year. After just three years at Indiana, Boring offered Skinner a senior position in Harvard's department of psychology. His salary was $10,000, with research funding guaranteed for five years. He was then aged 44 and "near the height of his intellectual power and vitality, and with a reputation and status that opened most doors to him" (Wiener, 1996, p. 115). Skinner was at Harvard for the rest of his career and lived in Cambridge for the rest of his life.

Skinner's Utopia

Skinner spent the summer of 1945 writing a utopian novel, *Walden Two.* In it he described an imaginary community in which operant principles of behavioral control are used to produce a harmonious and happy society. The community of *Walden Two* is set in a beautiful and bountiful land, an idealized version of the Susquehanna River valley of Skinner's youth. The community has happy and productive workers and well-behaved children whose ethical and moral training is completed by the age of 6. The standard of living is of such quality that community members spend their leisure time performing Bach's Masses, playing chess, and having scholarly discussions. It is a community where the Ten Commandments have been translated into explicit programs of behavioral control—indeed, a Skinnerian utopia.

Descriptions of utopias abound in Western literature, starting with Plato's (Chapter 1). In his *Republic,* Plato described a small city-state in which the culture and individualism of Athens were combined with the discipline of Sparta.

A small group of philosophers, the finest products of the educational system, would rule the state. Other people would be selected for different roles in accordance with their faculties and talents. Under the rule of a philosopher-king, *sub homine* (under man), men and women would find happiness and satisfaction.

In *City of God* (A.D. 426), Saint Augustine described a supreme utopia, the Christian heaven. There happiness is found in the sight of God, *sub deo* (under God), but only after death and only by a select group.

In his book *Utopia* (1517), Sir Thomas More, Lord Chancellor of England, described the evils and horrors of life in the England of his time: crime, poverty, cruel punishments, invidious class distinctions, and a licentious court. His remedy was a just and fair system of codified law, a society that functioned *sub lege* (under law).

Jean-Jacques Rousseau, in *The Social Contract* (1762), described a very different utopia. Inspired by the seemingly idyllic societies of the South Pacific described by the first European explorers of that enchanted region, Rousseau described a society in which humans find happiness by returning to nature, living *sub natura* (under nature). Only by living in harmony with nature and natural law would humanity ever find happiness.

Aldous Huxley's *Brave New World* (1932) is a satire that warns of the threat posed by psychology, especially by conditioning. Huxley saw conditioning techniques as a threat to human freedom and wrote his book to point out the dangers of a society *sub psychologia* (under psychology).

Skinner's aim in writing *Walden Two* was to describe a society *sub operando* (under operant conditioning). The community's leader is the character Frazier, and with him as an alter ego, Skinner was able to say things about the possibilities and techniques of behavioral control that he was not prepared to say himself at that time:

> I have only one important characteristic, Burris, I'm stubborn. I've had only one idea in my life—a true idée fixe . . . to put it as bluntly as possible, the idea of having my own way. "Control" expresses it, I think. The control of human behavior, Burris. In my early experimental days, it was a frenzied, selfish desire to dominate. I remember the rage I used to feel when a prediction went astray. I could have shouted at the subjects of my experiments, "Behave, damn you! Behave as you ought!" Eventually I realized that the subjects were always right. They always behaved as they should. It was I who was wrong. I had made a bad prediction. (Skinner, 1948, pp. 288–289)

Skinner described a community so successful that the initially dubious Burris resigns his university position and joins Frazier at *Walden Two* at the end of the book. Together they dream of founding additional *Walden Two*-style communities and even of taking over the whole country. In fact, only one such community was established, and it was only modestly successful (Kinkade, 1973).

Skinner wrote *Walden Two* in what he called a "white heat" in just seven weeks. Several publishers rejected the book before it was published in 1948. Many of the first reviews were hostile:

> The only thing I'm sure I really like in *Walden Two* is the radio.—*Herald Tribune*
>
> A depressingly serious prescription for communal regimentation, as though the author had read Aldous Huxley's *Brave New World* and missed the point.—*Time*
>
> A slur upon a name, a corruption of an impulse . . . such a triumph of *mortmain,* or the dead hand, has not been envisaged since the days of Sparta.—*Life*

Sales of the book were disappointing at first, but in the 1960s and 1970s, with the burgeoning interest in alternative lifestyles and counterculture, *Walden Two* became a bestseller, especially on university campuses. Skinner kept a neatly drawn cumulative record of the book's sales in his office. For many years of poor sales, the curve was close to the abscissa; but then it rose quickly as total sales exceeded 2 million copies.

Skinner's Applied Research

After the birth of his daughter Deborah, Skinner began to think seriously about the child-rearing environment a suburban home provided. He concluded that it was far from ideal. The child fusses and receives attention, and so fussing increases in rate; the child explores a bright, attractive object that happens to be an expensive vase and is punished for doing so; the child makes constant demands on the parents, who are not able to respond as they would like to. Skinner set out to design a better environment for his daughter. He began by analyzing her needs. The first was warmth. Rather than wrapping her in bulky clothing and covering her crib with blankets, Skinner built a small, well-heated compartment in which Debbie lived. A child must also be protected from illness. Skinner believed that most childhood illnesses are caused by airborne viruses, so the air entering Debbie's compartment passed through a series of filters. Freedom from bulky clothing and the presence of attractive toys encouraged Debbie to exercise and play. Skinner ensured her need for social contacts and interaction was satisfied by providing times each day when she was out of the compartment and had her parents' undivided attention.

In October 1945 the *Ladies Home Journal* published an illustrated article describing this device and the experience Skinner and his wife had had raising their daughter in it for two-and-a-half years. Here was one behaviorist who had followed Watson's challenge, "Give me a dozen healthy infants . . ." (Chapter 12), and exercised great control over the environment of his own daughter. The article reported that Debbie was a healthy and happy child who had not cried for six months except when given inoculations. Photographs showed an obviously happy Debbie frolicking naked in her compartment. Newspapers, radio, and *Pathé News* ran stories on this device, and Skinner received letters from hundreds of harassed parents asking where they could purchase one. Some people, though, were predictably outraged. The article's title, "Baby in a Box," conjured up images of social isolation and a cagelike environment. Skinner was accused of depriving Debbie of any social life and of the love and affection of her parents, of treating her like one of his rats or pigeons. One critic said that the only time human beings should be placed in a box is when they are dead. A mother who had used the box with her twins had a more pragmatic conclusion. "The box," she said, "is a boon to mothers because it cuts down on laundry and bathing" (Gerow, 1988, p. 45). In addition to gaining notoriety, the baby device proved to be a financial embarrassment. Skinner invested $500 in a company to build these "Heir Conditioners" only to have his fellow investor, the man who was supposed to manufacture the devices, disappear with his money and the deposits of potential buyers. However, some air-cribs, as the devices came to be called, were built, and 130 babies were raised in them without ill effects (Skinner, 1979, pp. 293–317). For many years, rumors circulated that Skinner's daughter had been permanently and negatively affected by her experience, and even that she had become psychotic. Happily, such was not the case. Deborah Skinner graduated with *Phi Beta Kappa* honors from Radcliffe College and became a successful artist. Looking back on her experience as the "baby in the box," she commented, "It wasn't really a psychological experience, but what you might call a happiness-through-health experiment. I think I was a very happy baby. Most of the criticisms of the box are by people who don't understand what it was" (D. Skinner, quoted in 1971, p. 51). Skinner's other daughter, Julie Vargas, who was not herself raised in the air-crib, decided to raise her two daughters in the device.

The next of Skinner's innovations grew out of his observations of the behavior of the teacher and the children in his daughter's fourth-grade classroom. He was distressed by what he saw as "minds being destroyed." Very little learning appeared to take place, and the little that did seemed to Skinner to occur in spite of, rather than because of, classroom reinforcements. With so many children in the class, the teacher was unable to attend to each of them at once, and so many behaviors that should have been reinforced were not. The children worked primarily to avoid threatened aversive events: the teacher's displeasure, their classmates' ridicule, poor test scores or grades, or a trip to the principal's office. Positive reinforcers were rare and, when administered at all, were usually delayed. Skinner's animal research had shown that delayed reinforcers are ineffective reinforcers, and so even these well-meaning attempts to provide positive reinforcers were probably ineffective. A further problem was that the teacher had to present information at the same pace for all the students. For some the pace was too fast, for others it was clearly too slow; yet they all had to proceed together. To Skinner, the classroom, with its primarily aversive control procedures, few and delayed positive reinforcers, lack of individual attention, and lockstep progression, seemed an environment guaranteed to produce learning difficulties. Skinner wrote:

> The condition in the average school is a matter of widespread concern. Modern children simply do not learn arithmetic quickly or well. Nor is the result simply incompetence. The very subjects in which modern techniques are weakest are those in which failure is most conspicuous, and in the wake of an ever-growing incompetence come the anxieties, uncertainties, and aggressions, which in their turn present other problems in the school. (Skinner, 1954, in Skinner, 1961, p. 151)

What could be done to remedy this situation? Skinner's solution was the development of teaching machines.

Early, innovative teaching machines had been developed in the 1920s by Sidney L. Pressey.[7] But his work was well ahead of his time, and his machines were not widely used beyond his home campus at The Ohio State University (Benjamin, 1988). Skinner devised a teaching system based on the operant principles of behavioral control established in his animal research. First, reinforcement would be immediate. The child would be told right away whether his or her response was correct or incorrect. Second, each child would progress at his or her own rate, moving on only when material had been mastered. Third, the material to be learned would be presented in small steps, with additional information presented when the child made an error. Learning would be shaped through a carefully constructed program of instruction.

Programmed learning with teaching machines and programmed texts has been used extensively in schools, colleges, and universities, not only in the United States but also in more than seventy-two countries around the world (UNESCO, 1973). There are at least a dozen journals devoted to programmed instruction and many books on the topic. Crucial to the success of such instruction is the quality of the programs. While some excellent programs have been written, it seems that more attention has been paid to the machines and gadgetry than to the quality of the programs themselves. Although Skinner (1961) predicted that programmed instruction could be used to teach such complex behaviors as calculus, musical composition, understanding the Bible, solving personal problems, and even thinking, his hopes have not been fulfilled. Programmed instruction has been used successfully to teach spelling and basic arithmetic in schools, and even the principles of Skinner's experimental analysis of behavior in colleges (Holland & Skinner, 1961), but programs to teach many other subjects have been less successful. Still, Skinner's teaching machines and techniques of programmed instruction were an important innovation. Today his behavior system is widely taught to teachers. Teaching is viewed as "reinforcement contingency management," teachers and students are encouraged to set "behavioral goals," classroom behavior is "shaped," and teachers regularly use "token economy" systems, based on conditioned reinforcers, and "time-outs," in which the child is removed from all stimuli and reinforcers for a brief period. Skinner's impact on education has been great.

[7] Skinner was not aware of Pressey's work. Boring, in his *History of Experimental Psychology,* attributed invention of the teaching machine to Skinner. The United States Commission of Patents issued two patents to Pressey for *Machines for Intelligence Tests* on March 4, 1930, and one patent for an *Examination Device* on December 27, 1932. In 1954, Pressey sent Skinner copies of his papers on teaching machines published between 1926 and 1932, along with copies of his patents. Both men behaved honorably. Skinner acknowledged the priority and importance of Pressey's work; Pressey supported Skinner's revival of teaching machines. Pressey's patents are in the Archives of the History of American Psychology at the University of Akron. In 1963, one of Pressey's teaching machines was added to the permanent collection of the Smithsonian Institution in Washington, D.C.

Skinner's Behavior Modification

Skinner also stimulated innovative approaches to shaping the behavior of people suffering from mental illness. His interest in the behavior of people diagnosed as neurotic or psychotic began in 1932, when he explored the possibility of shaping psychotic patients at the Worcester State Hospital in Massachusetts to press levers for various reinforcers. This project was never instituted, but in 1948, Paul Fuller, a graduate student at Indiana University, trained a "vegetative idiot" to make an operant response. This 18-year-old man had been institutionalized for many years and was diagnosed as severely feeble-minded. He lay on his back without moving, never made a sound, and did not eat or drink. Fuller shaped him to raise his right hand, using milk injected into his mouth as a reinforcer. After four conditioning sessions, the young man raised his arm consistently three or four times a minute. Despite his physicians' conclusion that he was incapable of learning anything, the young man had clearly learned to make this operant response. Fuller (1949) claimed that had time permitted, he would have been able to shape other responses, indeed to establish a small behavioral repertoire in this man.

Encouraged by Fuller's success, Skinner turned his attention to the diagnosis and treatment of mental illness. Freud's views were influential at the time (Chapter 8), but Skinner found Freud's concepts and treatment unacceptable. They were based, he claimed, on such "explanatory fictions" as id, ego, and superego; repression; and catharsis. Skinner also questioned the effectiveness of psychoanalysis as a therapeutic procedure. He recommended a new approach: observing a patient's behavior and then attempting to change it through appropriate contingencies of reinforcement. Skinner believed that many seemingly bizarre behaviors might in fact be orderly responses maintained by powerful reinforcers. Breaking these maladaptive reinforcement contingencies and substituting reinforcement for adaptive responses were the twin goals of the treatment procedures Skinner developed.

At Harvard, two of his graduate students, Ogden S. Lindsley and Nathan H. Azrin, pioneered what has come to be known as *behavior modification.* With Skinner, Lindsley established lever-pressing stations at the Boston Metropolitan State Hospital, where psychotic patients pressed the levers for such reinforcers as candy and cigarettes. Their behavior was orderly and predictable. After graduating from Harvard, Azrin established a behavior modification program at Anna State Hospital in southern Illinois. There Teodoro Ayllon (1963) modified the behavior of a psychotic woman with a nine-year history of towel hoarding. Whenever she stole or hoarded a towel, the nursing staff members were instructed to give her many towels. After four weeks, she was found to have 650 towels in her room. She then began to remove them and to resist receiving more. This satiation procedure had clearly changed the reinforcing value of towels. Ayllon and Azrin went on to establish programs of behavioral management for entire wards of patients and in 1968 published *The Token Economy,* describing their procedures and outcomes.

Skinner began to refer to himself not as a psychologist but as a *behavioral analyst* (Wiener, 1996, p. 100). Behavior modifiers have had reported success in controlling a wide variety of behaviors, including smoking, overeating, shyness, tics, speech problems, and autism (Ulrich, Stachnik, & Mabry, 1966; Bellack, Hersen, & Kazdin, 1982). In 1982, 852,000 mentally retarded children participated in special education programs in the United States (Scheerenberger, 1983), the vast majority of which were based on Skinner's principles of behavioral control and management (Gaylord-Ross & Holvoet, 1985). Most residential programs for the mentally retarded employ operant principles as a standard part of their treatment. There are now well over two dozen English-language journals devoted to behavior modification and many others in foreign languages; a division of the APA (Division 25) for "Skinnerian" psychologists; and several international behavior modification associations. Thompson (1988) stated:

> Interventions for human problems based on operant principles can be found from Auckland, New Zealand, to Reykjavik, Iceland, to Rome, Italy, as well as in every state in the United States. (T. Thompson, 1988, p. 399)

Despite these impressive achievements, numerous critics see behavior modification as a callous and even cruel attempt to manipulate and control. Patients, they have argued, have been deprived of their basic rights to good food, exercise, and a clean bed so that these items could be used as reinforcers. Often such critics challenge a wide range of techniques, including electroconvulsive shock, aversion therapy, isolation, and punishment procedures, labeling them all "behavior modification." Skinner's repeated protests that the term refers only to techniques using systematic application of positive reinforcers have been to no avail. In the face of this chorus of critics, behavior modification can now be used only under the most carefully controlled and supervised conditions.

Industrial Applications of Behavior Modification

Skinner often commented on the similarity between certain schedules of reinforcement and the pay regimes used in business and industry. Piecework schedules appear to be similar to ratio schedules of reinforcement, and weekly pay schedules are similar to interval schedules. At times, the similarities are striking. Just as an animal who has received reinforcement on a fixed-interval schedule often pauses before slowly increasing its response rate, workers paid on Fridays often exhibit "Monday morning blues" and some reluctance to work on Mondays. A number of attempts have been made to apply Skinnerian principles of operant control in a variety of industrial and business settings, often with striking success (Feeney, 1973). Other impressive applications include the use of reinforcement principles to prevent industrial accidents (Fox, Hopkins, & Anger, 1987) and the development of airline "frequent flier" programs—a form of token economy—which originally were designed to increase loyalty to a specific airline, but have had the effect of increasing air travel from 20 to 35 percent (T. Thompson, 1988, p. 399).

Skinner's Later Life

Skinner retired as Harvard's Edgar Pierce Professor of Psychology in 1974. He continued in his retirement to walk the two miles between his home in

James McConnell: Planarian, Science Fiction, Behavior Modification, and the Unabomber

During the 1960s, James McConnell was one of psychology's most colorful and controversial public personalities (Rilling, 1996). His initial notoriety came from experiments on invertebrate learning. McConnell claimed that naïve planarian (flatworms) showed savings in the acquisition of a conditioned response when fed the body parts of trained planarian. However, McConnell's experiments lacked controls for pseudoconditioning, sensitization, and experimenter bias. McConnell's critics included his graduate advisor, the comparative psychologist M. E. Bitterman (1975). Attempts by others to replicate the memory transfer results failed (Travis, 1980). Funding for his research program collapsed, but McConnell was unsinkable. In 1974, he wrote an introductory psychology textbook, *Understanding Human Behavior.* In a growing collection of introductory texts, McConnell's book was innovative in that each chapter featured a short science fiction story. The text is one of the best-selling introductory texts ever published. Many instructors who did not adopt McConnell's text for their classes used his text material in their lectures.

In 1959, McConnell founded *The Worm Runner's Digest* as a countercultural alternative to the *Journal of Comparative and Physiological Psychology.* In addition to research reports, many of which concerned memory transfer experiments, the *Digest* included humorous articles, commentary, and satire attacking and poking fun at the psychological establishment. This all came from a psychologist who, until the collapse of his planarian research, had received generous federal grant support and who headed a research laboratory at the University of Michigan. The *Digest* ceased publication in 1979, but for twenty years it was must reading for experimental and comparative psychologists and especially their graduate students.

McConnell turned next to behavior modification. He was not a practitioner, but an enthusiastic advocate for its extension to the control of criminal behavior. His articles in the popular press and in *Esquire* and *Psychology Today* are more propaganda than sound, research-based conclusions. Rilling (1996) describes the inevitable result:

> After the collapse of the planarian project, McConnell became a shill for B. F. Skinner's brand of behavior modification. A behavioral engineer could "guarantee" that a suitably retrained prisoner with a new personality would never commit a crime. Ultimately, McConnell became more adept at publicity than in providing original contributions to the science. (Rilling, 1996, p. 597)

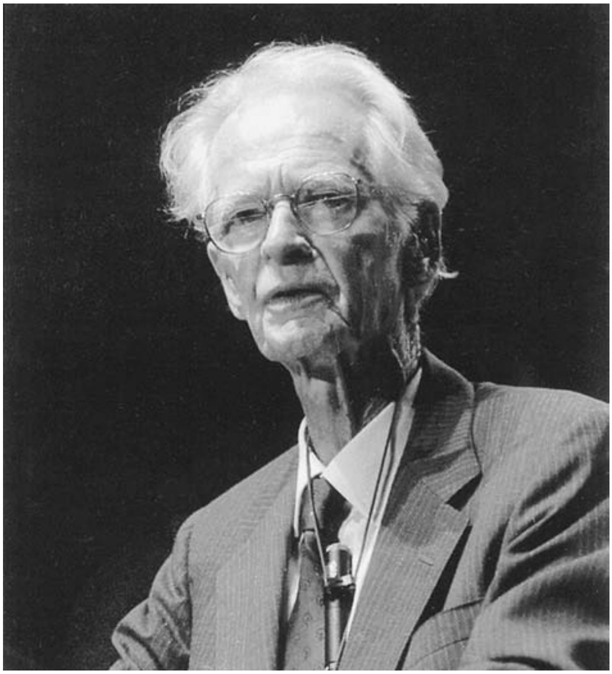
McConnell's advocacy of behavior modification came to the attention of Theodore (Ted) Kaczynski, later known as the Unabomber. Between 1975 and 1995, when he was apprehended, the Unabomber conducted a vendetta against science and technology, mailing bombs to executives in high-technology companies and to academic research scientists. On November 15, 1985, McConnell was the victim of an assassination attempt by the Unabomber. One of his research assistants was injured after opening a package mailed to McConnell's laboratory, and McConnell's hearing was impaired by the bomb blast. In January 1998, Kaczynski agreed to a plea bargain and was imprisoned for life.

Cambridge and his office in William James Hall at Harvard. There he would answer his correspondence, meet with visitors, many from overseas, and on occasion conduct research and meet with graduate students (Fowler, 1990, p. 1203). Skinner wrote his autobiography (Skinner, 1976, 1979, 1983) and edited a retrospective collection of his papers (Skinner, 1987). He kept careful records of the citation rate of his works in the psychological literature. In 1989, he wryly noted that for the first time his rate had exceeded Freud's (Lattal, 1992, p. 1269). Skinner continued to contribute innovative and controversial papers to the psychological literature (Skinner, 1989). In 1980, Robert Epstein, Robert Lanza, and Skinner responded to reports of symbolic communication between chimpanzees with an experimental demonstration of symbolic communication between operantly conditioned pigeons whimsically dubbed Jack and Jill. At the 1982 convention of the APA, Skinner presented an elegant behaviorist account of his own behavior while growing old, a report later expanded into a book called *Enjoy Old Age* (1983) that he coauthored with Margaret Vaughan. Skinner had little to say about loss, fear of dying, or the meaning of life. Rather, the book was a program of behavioral self-management for the elderly:

> Hang an umbrella on a handy doorknob if rain is predicted; that way it will not be forgotten.
>
> Read pornography to extend and pep up the sex life.
>
> Prepare new tricks to amuse grandchildren when they visit.
>
> Construct the environment so that you are not bothered by the inevitable decline in vision, hearing, physical strength, and endurance.
>
> Risk the contempt of younger contemporaries by freely admitting that you read detective stories and watch soap operas.

Skinner's career was a long and distinguished one, filled with awards, honors, and accomplishments: election to the Society of Experimental Psychologists in the early 1940s and receipt of the Society's prestigious Warren Medal in 1942, the presidency of the Midwestern Psychological Association in 1949, and of the Pavlovian Society in 1966. Skinner received the APA's Distinguished Scientific Contribution Award in 1958, the Gold Medal of the American Psychological Foundation in 1971, and the Humanist of the Year Award from the American Humanist Association in 1972. However, Skinner was never elected president of the APA.

On August 10, 1990, at the 98th annual convention of the APA in Boston, Skinner received a Gold Medal and a Citation for Outstanding Lifetime Contributions to Psychology. He is the only person to receive such an award in the history of the APA. Weakened by leukemia, Skinner addressed the convention and worked on a manuscript version of his address until the evening before his death on August 18, 1990. His paper "Can Psychology Be a Science of Mind?" was published in the November 1990 issue of *American Psychologist.* His answer to the title's question was an acerbic "No," as he categorized cognitive psychology as psychology's creationism. More than fifty obituaries appeared in the psychological journals and the popular media. The *American Psychologist* devoted an entire issue to *Reflections on B. F. Skinner and Psychology* (November 1992). In an editorial tribute to Skinner, Raymond D. Fowler wrote:



B. F. Skinner at the annual convention of the American Psychological Association, August 10, 1990, his last public appearance.
(Ellen Shub)

> The loss of this distinguished scientist is attenuated only by the realization of our good fortune in having him as a brilliant contributor to psychology for sixty-three years, more than half the history of the discipline. None can deny that he has made a permanent mark on psychology. The *American Psychologist* bids him goodbye with admiration and affection. (Fowler, 1990, p. 1203)

NEOBEHAVIORISM IN RETROSPECT

What can we conclude about these four neobehaviorist psychologists? They shared a definition of psychology as the science of behavior, but nevertheless, many differences defined them. Of the four, Guthrie's importance and influence have remained the most stable. He has long been considered an interesting and stimulating learning theorist whose *principle of contiguity* provides a powerful explanation of behavior. Tolman's *purposive behaviorism* enjoyed a period of popularity; but with the rise of Hull and Skinner, and their avowedly mechanistic approaches to behaviorism, Tolman's view went into a decline. In the 1970s, however, Tolman's position became increasingly attractive to psychologists interested in thinking and problem solving. To such cognitive psychologists, Tolman's experiments and concepts are of great value and interest.

Figures cited earlier in this chapter showed how Hull's theory of learning and behavior system clearly dominated the literature on learning. But more recently, the Hullian influence has waned. Skinner has also had a great impact on psychology. However, citation counts of his works in the *Journal of Experimental Psychology,* and for that matter in many other conventional psychology journals, would show percentages much lower than Hull's. Skinner's impact has been strongest outside such conventional psychology publications, often in journals such as the *Journal of the Experimental Analysis of Behavior* and the *Journal of Applied Behavior Analysis,* which were founded explicitly to publish "Skinnerian" research. Toward the end of his life, Skinner concentrated on philosophical and societal concerns. His death brought wide acknowledgment of his many contributions to psychology. It seems likely that Skinner's influence and importance will continue for many years, and that of the four neobehaviorists considered in this chapter, the legacies of Skinner and Tolman will be the most lasting.

Epilogue

This book has reviewed the development of psychology from its roots in antiquity; through philosophy and the great advances in physiology and other life sciences in the seventeenth, eighteenth, and nineteenth centuries; and finally, to Wilhelm Wundt's founding of psychology as an independent science late in the nineteenth century. Since then, many psychologists have been part of the "short history" of psychology. In considering some of them, I have emphasized not only their theoretical, empirical, and practical contributions to psychology, but also their lives and careers, successes and failures, triumphs and frustrations. As a result, this has been a biographic history of psychology.

What is the current status of psychology? In 1892, William James ended his *Psychology* with a consideration of psychology in his day and came to a pessimistic conclusion. According to James, psychology was:

> A string of raw facts; a little gossip and wrangle about opinions; a little classification and generalization on the mere descriptive level; a strong prejudice that we have states of mind, and that our brain conditions them: but not a single law in the sense in which physics shows us laws, not a single proposition from which any consequence can causally be deduced. We don't even know the terms between which the elementary laws would obtain if we had them. This is no science, it is only the hope for a science. (James, 1892, p. 468)

More than one hundred years later, has psychology met James's criticisms? Has the hope for a true science of psychology been fulfilled, or do we still have little more than a collection of gossip and opinion? Toward the end of his career, James became even more pessimistic about the status and prospects of psychology. The field still has numerous critics who question not only the reality but even the prospect of a true science of psychology. However, there is much in contemporary psychology that is interesting, important, and hopeful. Progress has been made, certain psychological phenomena are now understood, and some laws of behavior have been established.

Knowledge of the structure and functions of the nervous system and of the biological bases of psychological phenomena has advanced rapidly. The pioneering research of Pierre Flourens, Pierre-Paul Broca, Gustav Fritsch, Eduard

Hitzig, and even Roberts Bartholow has demonstrated that the brain can be studied scientifically and that some of its functions can be understood. Karl Lashley's *Brain Mechanisms and Intelligence*, published in 1929, directed the thinking and research of a generation of physiological psychologists. Donald Hebb's *The Organization of Behavior* (1949) provided a bridge between psychology and the rapidly developing neurosciences and a model for the effects of experience on the brain. Working in Hebb's laboratory in 1954, James Olds and Peter Milner discovered "pleasure centers" in the brain, a dramatic and totally unexpected finding. David Hubel and Thorsten Wiesel in 1969 described precise relationships between cortical cell activity and perceptual phenomena, while Roger Sperry's research with "split-brain" subjects demonstrated the different psychological functions of the two hemispheres of the brain (Sperry, 1961). For their research Hubel, Wiesel, and Sperry shared the 1981 Nobel Prize for medicine. The discovery in the mid-1970s of endogenous morphinelike substances in the brain (the endorphins) advanced our understanding of pain and perhaps even pleasure (Snyder, 1977). In 2000, Eric Kandel shared the Nobel Prize in physiology and medicine for his research on the synaptic changes that occur in learning and memory, specifically on the role of neurotransmitters.

The 1990s were congressionally anointed and presidentially proclaimed the "decade of the brain." The neurosciences, including psychology, are dedicated to a cross-disciplinary approach to understanding the relations between the brain, behavior, and cognition; arguably the biggest challenge humanity has ever faced. The neurosciences are one of the most rapidly growing areas of research and practice. Impressive progress has been made. Positron emission tomography (PET) and other direct brain-imaging techniques allow researchers to study the functioning brain directly; new medications have provided powerful treatments for mental illness and even such personality traits as shyness, impulsivity, and failure to concentrate. The anti-depressant drug Prozac is now so ubiquitous it has been described as having its own "culture" (Cowley, 1994) and counts worldwide sales of $1.5 billion per year. According to one prediction, most of the new psychoactive drugs will be aimed not at patients, but at people who feel the need to enhance their memories, intelligence, or concentration, or to alter their moods (Restak, 1994).

The development of psychoactive drugs has led to intense debate as to who should prescribe them. Historically, prescription privileges have been restricted to physicians. In recent years, there has been a growing interest among some psychologists in obtaining prescription-writing privileges. In 1990, the Council of Representatives of the APA voted 118 to 2 to establish a task force on gaining prescription privileges for psychologists. Council members emphasized that such a development would lead to a higher quality of life for the elderly, the homeless, and rural residents and would further the development of better treatments in women's health care (DeLeon, Fox, & Graham, 1991, p. 384). Bills extending prescription privileges to psychologists have been introduced in a number of state legislatures, including Hawaii's. In 1989, the United States Department of Defense authorized a demonstration and training project in which military psychologists were to be trained and authorized to issue certain psychoactive drugs and medications.

Many physicians and psychiatrists question the training and competence of psychologists to prescribe drugs. Some psychologists also oppose granting prescription privileges to their colleagues. Kingsbury (1987), who is both a clinical psychologist and a psychiatrist, has detailed the many reasons for misunderstanding and conflict between psychologists and psychiatrists. Though Kingsbury himself, as a psychiatrist, prescribes drugs, he opposes prescription privileges for psychologists (Kingsbury, 1992). He predicts that such a step will inevitably lead to the domination of psychologists by psychiatrists. May and Belsky (1992) argue that prescription privileges would cause the further "medicalization" of psychology and would inevitably lead to an attenuation of the unique contribution psychologists make. It is clear that powerful professional and economic forces are at work in this debate. The outcome will do much to define the future role of psychologists and the relation between psychiatry and psychology in the coming decades.

Though successful treatments for the 4 million Americans suffering the devastating consequences of Alzheimer's disease have not yet been developed, some progress has been made in understanding the biological bases of that debilitating condition. Other debilitating neurological diseases have seen much more progress made. The March 26, 1993, issue of the journal *Cell,* in a paper with fifty-eight authors, including psychologist Nancy S. Wexler, announced the genetic basis of Huntington's Disease (HD). HD is a neurodegenerative genetic disease caused by atrophy of brain cells in the basal ganglia. It affects mood, cognition, and motor control. Victims are tragically aware of their own fatal decline, which may last as long as twenty years. In 1979, Wexler began the search for the HD gene in a large Venezuelan family of almost 200 people afflicted with the disease. Origins of the disease in that family were traced to one woman. Members of Wexler's Collaborative Research Group on HD were able to identify and isolate the gene carrying the disease. Though a cure has not yet been found, a test to verify the diagnosis, or even to predict the disease before the onset of symptoms or even prenatally, has been developed. Such a test raises many moral and ethical questions. Wexler herself, whose mother was afflicted, has a 50 percent chance of developing HD. She has chosen to keep private her decision as to whether or not to be tested. Her situation is a poignant illustration of the dilemmas which will become increasingly common as knowledge expands.

Psychosurgery still has its advocates (Rodgers, 1992), but a more promising approach is to consider a variety of potential neurosurgical and related interventions for psychological and psychiatric disorders. Psychologists will play a critical role in testing such procedures and monitoring their application.

Recently developed statistical procedures allow the analysis and interpretation of psychological data in a way that was impossible as little as twenty years ago. For example, factor analysis techniques have been used to analyze masses of data bearing on human personality and intellect and to develop empirically based descriptions of personality traits and models of intelligence. Raymond B. Cattell, one of the contemporary advocates of such an approach, predicts that factorial descriptions of personality will allow accurate predictions of behavior. Cattell's precise statistical approach to personality may be traced back to Sir Francis Galton in the nineteenth century, though Cattell's techniques are incomparably more powerful than anything available to Galton (Cattell, 1965; Cattell & Kline, 1977). Would this approach to the complexities of personality impress James? One can only speculate, but perhaps he would have seen in it a way of testing his own descriptions of "tender-" and "tough-minded" personality types.

Today's electronic instruments make possible precise presentations of stimuli, accurate records of behavioral responses, detailed recordings of activity in the nervous system, and impressive modes of data acquisition, storage, and analysis. James professed a horror of the "brass instrument" psychology of his time, but surely even he would be impressed by the apparatus, equipment, and techniques found in a modern psychological laboratory. Computers allow us to implement complex statistical analyses and develop causal models of psychological processes that were previously impossible.

Computers have also changed psychologists' very conceptions of psychological phenomena. The switchboard models of stimulus-response connections the early behaviorists proposed have been supplanted by computer models and an information-processing viewpoint concerned with the acquisition, storage, and retrieval of information. Herbert Simon's *The Sciences of the Artificial* (1969) described classical psychological problems by using computer analogies. Later Simon and his coworkers studied artificial intelligence. Their programs allowed computers to solve problems, to remember, and even to reason (Newell & Simon, 1972). In 1979, Simon won a Nobel Prize for his research in economics, but today he is better known as a cognitive scientist. Recent collaborative research between psychologists and computer and information scientists has led to the development of expert intelligent systems (Solso & Massaro, 1995). Neural network models have been applied in areas that range from the functioning of a single synapse to the essence of consciousness (Wang, 1993). Gestalt laws of perception have been used to provide the input coherency required for neural network recognition of patterns (Rock & Palmer, 1990).

Cognition has been restored to a central position in psychology, a development James would certainly have welcomed. In his time, cognitive psychology was under active development by psychologists of the Würzburg school. Disruptions caused by World War I and the behaviorist revolution of John B. Watson diminished the impact of such early cognitive psychologists as Franz Brentano and Carl Stumpf. For two to three decades, behaviorism dominated psychology, and indeed, Watson's successor, B. F. Skinner, continues to have a strong influence on contemporary psychology. However, in recent decades, interest in cognitive psychology has revived, leading to what has been termed psychology's cognitive revolution (Lachman, Lachman, & Butterfeld, 1979). The British psychologist Donald Broadbent developed a model of human attention which led to a productive research program (Broadbent, 1958). In the United States, George Miller, Eugene Galanter, and Karl Pribram advocated a new cognitive psychology that would study plans, images, and other mental processes (Miller, Galanter, & Pribram, 1960). The 1960s also saw Noam Chomsky's influential conclusion that the structure of language is innate (Chomsky, 1965) and witnessed detailed studies of mental imagery (Paivio, 1969), short-term memory (Sternberg, 1966), and organizational processes in memory (Mandler, 1967; Bower, 1970). Finally, developments in linguistics, computer science, and artificial intelligence have strongly influenced psychology. Today cognitive psychology is one of the most dynamic and interesting areas of psychology. Psychologist Daniel Kahneman shared the 2002 Nobel Prize in economics. He was cited by the Royal Swedish Academy of Sciences "for having integrated insights from psychological research into economic science, especially concerning human judgment and decision making under uncertainty" (*APS Observer,* 2002). Kahneman's research demonstrated how human decisions may systematically depart from those standard economic theory predicts.

Today's developmental psychology is very different from the field founded by G. Stanley Hall, though Hall's influence is still important. Hall's catalogues of child development proved to be of lasting value, as his student Arnold Gesell (1954) elaborated and extended them, leading to developmental measures of intelligence. This normative approach to development was revolutionized by the work of Jean Piaget (1954), who used careful observations coupled with innovative tests of thinking to stimulate three decades of research on the development of cognition as well as moral development. Another area Hall pioneered, the study of aging, has recently returned to prominence and become a most important area of contemporary psychology as the population ages. Today's life-span approach to developmental psychology is a direct legacy from Hall.

Social and industrial psychology have also developed apace since James's time. Kurt Lewin's ingenious experiments on social behavior find a contemporary reflection in Stanley Milgram's (1963, 1974) studies of compliance with authority. Milgram's Yale experiments demonstrated the surprising ease with which people could be directed to act destructively for a perceived authority. This obedience research brought Milgram worldwide fame, but also earned him criticism for conducting the research, and more generally for using deception in psychological research (Blass, 1996). Also provocative were Bibb Latané and John Darley's (1970) investigations of the "unresponsive bystander," and the dramatic simulation of the prison experience by Zimbardo, Haney, and Banks (1973). These investigations challenged our expectations of human behavior and presented demanding questions. Hugo Münsterberg's pioneering research in industry and business founded the field of industrial and organizational psychology, which today are important and accepted applications of psychology. Similar progress could be cited in other areas of psychology. In clinical psychology, for example, few would doubt that the 1980s were better times for the mentally ill than the 1880s or even the 1930s were.

Yet much remains to be done in all areas of psychology, and some critics question whether psychologists will ever make the required progress. They consider psychology a "soft" science or even a "pseudoscience." Psychological research has at times been ignored or ridiculed as a waste of time and money. In the majority of these cases, careful consideration of the research itself, especially in its historical context, has shown it to be serious and important (Atkinson, 1977). Even psychology's Nobel laureates would fail to impress such critics. The prizes, they might claim, were awarded to physiologists (Hubel and Wiesel), a neurosurgeon (Sperry), an economist (Simon), and a physiologist (Kandel), rather than to four psychologists. In this, history indeed repeats itself, for the man often considered psychology's first Nobel prizewinner, Ivan Pavlov, always considered himself to be a physiologist. While it must be admitted that psychology has not attained the rigor of the older sciences and that the number of psychological laws is still small, our review of the history of psychology shows that progress has been made.

Psychologists continue an active interest in the history of their discipline. Recent research and scholarship have emphasized important contributions to the history of psychology from women and members of minority groups (Milar, 2000; Guthrie, 1976). We can learn much from the struggles of these neglected groups. In many colleges and universities, psychology is chosen as a major field of study by large numbers of students. Often a history of psychology course is a central or capstone part of their undergraduate curriculum.

One aspect of contemporary psychology that surely would amaze James is its size. After decades of slow growth, the number of psychologists has increased greatly, and there are now some 84,400 members of the APA and smaller but still significant numbers of psychologists overseas. The APA's annual convention is held in a large city, often in more than one hotel or a convention center, with as many as 15,000 registrants and a program of more than 500 pages. By contrast, James knew all the important psychologists of his time personally (Dewsbury, 2000). Today no psychologist could make such a claim, and it is the fortunate few who know even the majority of psychologists in their own areas of specialization. There are now fifty-one divisions of the APA, more divisions than the number of psychologists who attended the APA's first meeting in 1892. These divisions were formed to meet the specialized needs of the association's members, which they clearly do in the meetings they organize and the journals they publish. Yet with this increased specialization comes the danger that psychology may be Balkanized into many competing and quarrelsome factions. That danger became apparent in the 1980s as an increasingly bitter struggle developed over the structure and priorities of the American Psychological Association. APA members favoring an academic/scientific approach came to believe that the APA had betrayed its heritage and become irrelevant to their concerns with its increasing emphasis upon the practice of psychology. They saw the APA as an advocate for the practitioners of psychology. The struggle became a bitter internecine political struggle that left many psychologists feeling torn, battered, and pessimistic over the future of their discipline. An alternative organization to the APA, the American Psychological Society (APS) was founded in 1988 with 450 charter members. They described themselves as "scientifically oriented psychologists interested in advancing scientific psychology and its representation as a science at the national level." Their aim was "advancing the scientific discipline of psychology and giving away of psychology in the public interest."[1] Five thousand psychologists joined the APS within six months of its founding. With a stated goal of recruiting 20,000 members, APS was seen by some as a threat to APA and to psychology itself. With two rival organizations, who would speak for psychology and psychologists? Who would edit, publish, and control the APA journals, the very

[1] See the American Psychological Society web page.

heart of psychology itself? Many psychologists felt compelled to choose between the two organizations, while others elected membership in both, and a smaller number withdrew from both.

The APS has seen remarkable growth; it now has 12,000 members and has increased its membership goal to 25,000 (Brewer, 1994, p. 10). The society publishes two excellent journals, *Current Directions in Psychological Science* and *Psychological Science.* Ironically, as the APS has grown, it has lost one of its distinguishing characteristics—its relatively small size. The number of psychologists attending the annual APS convention has grown each year. Managing that growth and remaining true to its charter and purpose will be major challenges for the APS. The APS has also affected membership in such groups as Psychonomic Science, devoted exclusively to psychology as a science. But as the APS has matured and gained acceptance from most members of the APA, there are encouraging signs that the two organizations have found a mode of operation that allows them to work together for the advancement of psychology as both a science and a profession.

Finally, some clear trends emerge from a consideration of psychology's history. An empirical analysis of publications in four leading journals of psychology (*American Psychologist, Annual Review of Psychology, Psychological Bulletin,* and *Psychological Review*), dissertations in psychology, and citations from 1950 through 1997 detected the following trends:

- Psychoanalytical research has been virtually ignored by mainstream scientific psychology over the past several decades, with publication percentages of from 1 to 2 percent.
- Behavioral psychology, after a period of relative dominance from 1950 to 1979 with publication percentages as high as 9 percent, has declined in prominence in recent decades, with publication percentages around 3 percent.
- Cognitive psychology has sustained a steady upward trajectory, from publication percentages of 2 percent in the 1950s to a publication percentage of 18 percent from 1995 to 1997.
- Neuroscience has seen only a modest increase in mainstream psychology, despite clear evidence for its conspicuous growth as reflected in publications in numerous other journals (Robins, Gosling, & Craik, 1999, p. 117; Gray, 2002, p. 21).

Such trends show that psychology is a dynamic field. Psychology is also an honorable profession. If this *History of Psychology* provides any student encouragement to study psychology and consider a career as a psychologist, its writing in this and earlier editions will have been most worthwhile.

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