Part I

Overview of the Research Process

Chapter 1
Research and the Social Sciences

CHAPTER OBJECTIVES

The whole of science is nothing more than a refinement of everyday thinking.
—Albert Einstein

Introduction

Welcome to one of the most critical courses in the curriculum for any degree. A basic understanding of research is especially important in the social sciences. Understanding something as complex as social interactions or human behaviors and cognitions is not easy. Without an empirical, scientific approach to the development of a body of knowledge, our understanding of people will be incomplete and rife with error. Having a solid understanding and appreciation of research methods will help you to fully connect with the field you are preparing yourself for at this very moment. Each of us, your authors, is passionate about research for very different reasons. The three of us are psychologists, but our interests and research overlap with many other areas. As you read this text, an understanding of who we are and where we came from may help you to better place the techniques and concepts related to research methods in context with your own career goals. So you can have some idea of where we are coming from in future chapters, here are brief bios for you to consider:

Bart Weathington

I became an academic and "researcher" in a nontraditional way. Growing up I was always fascinated by science (due in part to some very good teachers along the way). I was also very interested in understanding why people behave the way they do. My dad spent most of his career as an industrial engineer helping to streamline processes and improve industrial efficiency. I knew very early that engineering was not for me, but discussions with my dad about what he did for a living instilled in me an understanding that the most important component of any project is the people involved. I went through seven majors in college before figuring out that psychology was, for me, the best combination of my interests. I lucked into a course on psychology applied to business in my junior year and from that time on I knew that was what I wanted to do. However, I was much more interested in applying knowledge than in creating it.

I went to graduate school with the intention of becoming a consultant upon graduation. I wanted to help organizations solve real-world problems and help individuals maximize their potential. Little did I know that the best way I would find to do this would be to combine teaching, consulting, and research. I discovered that the best way to apply knowledge is to have an understanding of how it was learned in the first place. Understanding research methods is the key to this process. I began my career as a consultant who did a little teaching and research on the side. Now I am a teacher and researcher who consults a little on the side. It is my firm belief (and I hope you will take the same understanding away from this text) that understanding how knowledge is identified, created, and refined (i.e., research methods) will help you make better decisions in the future—whether you become a researcher yourself or if you never conduct your own research study outside of a classroom setting. Being an informed consumer of research is as important as being an informed researcher.

Chris Cunningham

Psychology is in my family, but that's not why I became an Industrial-Organizational (I-O) psychologist. My dad was (and still is) an extremely busy child-and-school psychologist, and my mom is a professor of education at a local college. Thinking about thinking and behavior was probably our favorite pastime and also the source of many dinner-table discussions. This didn't translate into career goals until the summer between my freshman and sophomore years in college. That summer I lived by Lake Champlain in northern Vermont working as a temporary employee in a variety of roles (think ticket sales and light construction). The work was boring and tedious and I spent a lot of time thinking seriously about what kind of work would actually interest and motivate me for the long haul. Ultimately I decided to major in psychology, but this merely left me with the inevitable question, "Now what do I do?" Over the next two summers, I worked as a child-care counselor and psychiatric intern at a residential treatment facility and hospital in Pennsylvania. Although extremely important, this type of work was not personally rewarding. Pouring my heart and soul into providing therapy and assistance to patients, watching them "finish" treatment, and then watching them be readmitted weeks later in worse shape than before really bothered me.

I began to wonder whether there was another way for me to have a positive impact on peoples' lives without working in a clinical setting. Remembering my temporary worker experiences and other jobs I had held, I decided to prepare myself for graduate school in Industrial-Organizational psychology. I wanted to figure out a way to improve people's lives through their work environments. To move toward this goal, I began to focus heavily in graduate school on occupational health and safety issues. The one constant through all of this was my passionate desire to understand something and make things better.

(*Continued*)

These interests can be satisfied only with good research, and I learned the skills and techniques for this from my psychology training as an undergraduate and graduate student. This drive to learn something new every day and share that with other people is what gets me out of bed every morning. Having an understanding and appreciation of proper research methods and statistical analyses has allowed me to respond to a wide variety of challenges in my academic and consulting work and I sincerely believe these skills form the core of any social science career.

David Pittenger

I fell in love with psychology in high school when I took a general psychology course. When I entered college I decided to be a psychology major. More specifically, I wanted to be a clinical psychologist. I imagined that I would sit in my office, listen to clients tell me their problems, and then dispense helpful advice. All I needed to do was learn how to do therapy—or so I thought. During my first term at college, I took three courses: a freshman orientation seminar, an introduction to philosophy, and an introduction to psychology. From the first day, the psychology instructor emphasized that psychology is a science and that we would learn how psychologists use the scientific method to understand human behavior. What a shock! I had taken biology, chemistry, and physics in high school. These were sciences—how could anyone confuse psychology with a science? What really startled me was when the instructor told us about the major. After the introductory course, we would have to take a course in statistics and then another course in research methods. Then, in our senior year, we would have to conduct a scientific study related to psychology. Math was never my favorite subject, and I had planned to dodge college-level mathematics as artfully as I could. I began to doubt my decision to major in psychology. Was all this science stuff really for me? Was I in the right major? I wanted to help people. Why did I have to suffer through courses in statistics and research methods? Then something interesting happened. My philosophy course surveyed great ideas in western thought. During the middle of the semester, I realized that my philosophy instructor talked about the same topics as my psychology instructor. For example, in my philosophy course we read sections from Wittgenstein's essay on the meaning of words. In the psychology course we learned how psychologists study children's language development. I recognized then that psychologists study many of the same questions that have confronted the great thinkers throughout history.

When I began graduate school, I still wanted to be a clinical psychologist and hoped to learn how the science of psychology guided therapists to new and effective treatments. By then I was not surprised to learn that my coursework included statistics and research methods. Even the courses in clinical psychology emphasized how psychologists use research to determine the effectiveness of different therapies. When I finished my master's degree, I worked in a residential psychiatric hospital as a counselor. I was a member of a treatment team and offered group and individual therapy under the direction of the ward's psychiatrist. Although I enjoyed my job, I noticed that something was missing. How did we know that our therapy worked? Our clients got better; but did their improvement reflect our efforts, or did they just get better? Other questions nagged at me. Why, for example, do people continue to do something that they have agreed is self-destructive? Why was a specific treatment useful for one client but not another? When I shared my questions with a former professor, his response was, "David, you are asking questions like an experimental psychologist. You want to understand what causes behavior. Go back to graduate school and follow your interests." I did. I returned to graduate school, where I studied the foundations of psychology—learning, memory, and the physiological basis of behavior—and I am now a professor of psychology teaching the courses that I once dreaded.

Why Is Understanding Research Methods So Important?

Although there are differences across specialty fields in the social and behavioral sciences, there are three core types of information that anyone specializing in these areas must know. The first is basic statistics. The second is to understand the proper methods for developing and evaluating psychological tests and surveys researchers use to measure human thought and behavior. The third is how to conduct and interpret high-quality research. In this book, we will help you with the third type of information. Mixed in the chapters we will also remind you of important statistics that might help you along the way. We will also provide you with the basic information needed to begin the test development and evaluation process. If you feel you need a refresher in basic statistics, a review is included in Appendix A.

Why are these three core topics so important? Think about it—researching, analyzing, and reporting are the skills from your education that will help you find a job, keep a job, and make a contribution to society. You can think big thoughts and theorize all day long, but without these three skills, these great ideas will never translate to credible and applicable science. We do not want your good ideas to be restricted by the boundaries of your mind. This is why we all sincerely hope that you are not dreading this course or fearing something nonspecific about science or research. There is nothing scary here; just a systematic approach to learning, understanding, and questioning that will benefit you no matter what you decide to do with your degree once you graduate. There are many ways to study human behaviors and cognitions, but most prefer to use the scientific method in some way, shape, or form. Statistical description and analysis techniques provide structure to these methods, and good test development and utilization provide the conduit through which good research is conducted. In other words, to become a proficient social scientist you must learn to work with the tools of the trade: the scientific method and its attachments, statistics, and tests and assessments.

The Role of Science in Everyday Life

Thought-Starters

What are some examples of science in your life?

Have you "researched" anything today?

What are some big decisions or questions you are currently considering?

H. G. Wells, the nineteenth-century author, predicted that "statistical thinking will one day be as necessary for effective citizenship as the ability to read and write" (as cited by Campbell, 1974). We strongly believe this prediction has come true. Although you may not plan to become a researcher, obtaining and using an advanced degree in any field of the social sciences (and in many areas of life in general) will force you to confront

issues that can be addressed only with the aid of scientific research. Consider the following example issues:

What effect does child care have on child development?

What are the best ways to prevent drug abuse?

Are treatment programs for drug and alcohol abuse effective?

Will a specific test accurately predict how well a person will do on a job?

Will this new drug cure multiple sclerosis?

What is the best way to present new information to a large group of people?

These are clear and direct questions that anyone could ask. Will you send your children to day care? If you do, what will you look for in the program? As a parent, what should you do to discourage your children from using illegal drugs? If you have a management position, should you use personality tests to predict who will be a good employee? These are the types of questions you will face when you start to apply your social sciences training to the real world. Knowledge of the scientific method can be invaluable where the rubber meets the road.

Take, for example, the classic legal case of *Daubert v. Merrell Dow Pharmaceuticals, Inc.* (1993). In this case, the Supreme Court ruled that judges, not jury members, must determine the merits and scientific validity of testimony given by expert witnesses. In response to the court's decision, the Federal Judicial Center developed the book *Reference Manual on Scientific Evidence* (1994) to help judges and lawyers understand the principles of research methods and statistics. As the authors of the book noted, "no longer can judges . . . rely on their common sense and experience in evaluating the testimony of many experts. . . . The challenge the justice system faces is to adapt its process to enable the participants to deal with this kind of evidence fairly and efficiently and to render informed decisions" (p. 1). As H. G. Wells predicted, the knowledge of the scientific method is now a vital part of our government and judicial system and therefore our everyday lives.

Apart from knowledge of proper research procedures, there may also be cases where you will have to directly collect and analyze data for your own purposes. Many psychology and sociology majors, for example, want to work in some form of counseling or social service agency. Effective clinical psychology and counseling processes closely follow the scientific method. Giving a psychological test and interviewing a client are forms of data collection. A psychological test is a specialized statistical tool. To understand the results of the test, you will need to understand basic statistical principles. Many clinical psychologists must also conduct outcomes assessment research to evaluate the effectiveness of the treatment they provide (Ogles, Lambert, & Masters, 1996). Taken a step further, those who pay for mental health therapy (e.g., often insurance companies) want to be sure that the cost of such therapy is justified (i.e., that the therapy actually works). For

this reason, mental health providers routinely need to collect, analyze, and report data that demonstrate the effectiveness of their therapies.

You are not alone if you fear statistics and research methods. Many people seem to detest anything related to mathematics and statistics because they do not understand the relevance or importance of these topics to their own lives. We hope that by the time you finish this text you will know that the relevance has been there all the time—understanding how to do good research and work with statistics will be skills you can use for the rest of your life.

The Scientific Method

The scientific method is really the most critical concept in this course for you to remember and understand. Knowing each of the steps in this process and how they are managed will allow you to conduct the highest-quality research possible. Sometimes the most difficult challenge for students in courses such as these is figuring out how to remember the core elements of a topic so that they can then (hopefully) attach some meaning to these elements and retain this knowledge in their long-term memory. Perhaps the easiest way to remember the scientific method from start to finish is to learn the mnemonic *HOMER* (Lakin, Giesler, Morris, & Vosmik, 2007):

1. *H*ypothesize
2. *O*perationalize
3. *M*easure
4. *E*valuate
5. *R*eplicate, revise, report

These are the core steps to the scientific method and they should sound vaguely familiar from middle school and high school science and various introductory social science courses you may have taken. The rest of this text focuses on ensuring you will finish with a working knowledge of all five components.

Brief History of the Science of Behavior

Science is a way of thinking about and explaining the world around us. The scientific method consists of the process used for collecting, analyzing, and drawing conclusions from data. Research methods and statistics are complementary techniques that we use to acquire information and reach reasonable conclusions. When we speak of research methods, we refer to procedures for collecting information. When we speak of statistics, we refer to procedures for organizing, summarizing, and making inferences from the data.

Before we get into the real meat of this course, a little history lesson is necessary. It will be relatively painless, we promise. To understand where you are and where you are going, we think it is helpful to first tell you where social science has been and how it has developed. As formalized fields of study, the social sciences are technically young. However, as German psychologist Hermann Ebbinghaus (1850–1909) wrote, "psychology has a long past, but only a short history" (1910, p. 9). How can this be? Well, we know that the Greek philosophers wrote extensively about many familiar topics, including learning, language, memory, and dreams. Although many writers and great thinkers wrote about how they thought the mind works, none conducted anything that we would call an experiment. The problem is that the mental events are difficult to observe and measure. Consequently, many philosophers believed that we could not observe or measure mental events in the same way that we observe or measure physical objects.

This perception exists even today and has resulted in the social sciences being labeled as the "soft" sciences, a term that suggests that other sciences such as chemistry and physics (the so-called "hard" sciences) are more accurate or empirically valid. Interestingly, essentially identical methods are utilized across all of these scientific fields (Hedges, 1987). It is the subject matter that sets the social sciences apart. Properly designed and implemented research in the social sciences can be as valid and replicable as any other research. Historically, though, before this research could be conducted, a profound shift in studying human social interaction and behavior had to occur.

Although Greek philosophers had a profound effect on the generations of scholars who followed them, it was not until the questioning of these ancient authorities that the scientific revolution occurred. During this revolution, seventeenth-century scientists decided that there was more to learn about nature than the ancient philosophers had described in their writings. One of the more articulate spokespersons for the new scientific revolution was Sir Francis Bacon. Much of the scientific method as we know it today evolved to overcome and protect us from several basic human biases or "idols" that Bacon (1620/1994) outlined in his seminal book on this topic.

Interestingly, Sir Francis Bacon (1561–1626) was not a scientist, but rather a British politician. He was interested, however, in the developments of empirical science and became one of its strongest proponents. In 1620, he published a book on the scientific method titled *Novum Organum* ("the new instrument"). Bacon saw the scientific method as a better path to good answers. Like many of his contemporaries, Bacon distrusted the wholesale belief in everything that the ancient philosophers had to say. He (Bacon, 1620/1994) wrote, "For the ancients . . . out of a few examples and particulars, with the addition of common notions and perhaps some portion of the most popular received opinions, they flew to the most general conclusions or principles of the sciences . . . through intermediate propositions, they extracted and proved inferior conclusions" (p. 127). In essence, Bacon accused the earlier philosophers of making hasty generalizations that have

little or no merit. He also argued that to comprehend the physical world, we must use the scientific method to ask and answer questions.

Bacon's most important and lasting contribution to the history of science may be his discussion of common human biases that can cause us to make irrational decisions or ignore important information. According to Bacon, there are four main human biases that hinder our ability to think clearly. He referred to each of these biases as the **Idols of the Tribe**, **Cave**, **Marketplace**, and **Theatre.** Bacon's observations were as insightful in their own time (early 1600s) as they are now. Indeed, we continue to rely on the scientific method, statistics, critical thinking, and analysis skills to overcome the obstacles to learning that each of these idols creates.

Idols of the Tribe

The first source of bias described by Bacon was our human tendency to rely on intuition and common sense to reach conclusions. Bacon (1620/1994) suggested that:

> The Idols of the Tribe *lie deep in human nature itself and . . . it is wrongly asserted that the human sense is the measure of all things. It is rather the case that all our perceptions . . . are reflections of man [sic]* not of the universe, and the human understanding is like an uneven mirror that cannot reflect truly the rays from objects, but distorts and corrupts the nature of things by mingling its own nature with it. (p. 56)

Bacon recognized that many people have a tendency to believe that what they see and how they interpret events is accurate, and that their common sense is well informed and infallible. This tendency leads us to selectively perceive events around us, trust our first impressions, and then uncritically use those impressions to make decisions.

A common example of the Idols of the Tribe is a **self-fulfilling prophecy.** A self-fulfilling prophecy occurs when we believe something is true and our beliefs then influence the way we perceive and react to specific events to confirm our beliefs (Baron, Graziano, & Stangor, 1991). In most cases, we are unaware of how our attitudes affect our behavior. Moreover, when we believe something to be true, we tend to remember events that agree with our beliefs and forget or ignore events that disagree with our beliefs. At the heart of the problem is that our preconceived ideas have considerable influence on how we interpret and react to different situations.

Many researchers (e.g., Nisbett & Ross, 1980; Rosnow & Rosenthal, 1997) have examined the shortcomings of human decision making. The consensus among researchers is that humans tend to rely too much on intuition and common sense to make decisions. Another example of the Idols of the Tribe is the **gambler's fallacy.** If a person tosses a coin three times in a row and gets heads each time, most people believe that the fourth toss of the coin *must* be tails. Some people will argue, "It makes *good common sense* that you cannot have four heads tossed in a row!" However, the probability that the coin will land heads on the next toss is fixed at 50% (unless the coin is weighted). Many people make this error because they

trust their intuition and preconceived beliefs about probability; that is a sure way to lose a lot of money at the gambling tables. In summary, the Idols of the Tribe refers to the human tendency to depend too much on common sense and to the tendency to make consistent errors in logical reasoning. *Why do you think this is a problem for science to avoid?*

Idols of the Cave

This second source of bias is formed from the effect of our exposure to culture, common practice, and education on our processing of information. According to Bacon (1620/1994), our life experiences shape how we look at things. Although our experiences are valuable, there are important sources of limitations. As Bacon (1620/1994) described them, "The *Idols of the Cave* arise from the individual's particular nature, both of mind and body, and come also from education, habits and by chance. Though there are many different kinds, we cite those which call for the greatest caution, and which do most to pollute clear understanding" (p. 61).

The problem with personal experience is that it is personal, unique to you. Chances are that your background and our backgrounds are very different. Who is to say which of us has a more *valid* or accurate worldview? Each of us has experienced different important events in our lives. These events shape our beliefs and perceptions and affect how we perceive things. Although these beliefs and perceptions make us unique, we need to recognize their effect on our decision making and reasoning. Karl Popper (1902–1994), a famous philosopher, provided an interesting example of depending too much on personal experience. Early in his career, Popper worked with the psychotherapist, Alfred Adler, who had developed a comprehensive theory of personality development based on his clinical experiences. Popper (1963) described the following episode:

> *Once . . . I reported to him [Adler] a case which to me did not seem particularly Adlerian, but he found no difficulty in analyzing in terms of his theory of inferiority feelings, although he had not even seen the child. Slightly shocked, I asked him how he could be so sure. "Because of my thousand fold experience," he replied; whereupon I could not help saying: "And with this new case, I suppose, your experience has become thousand-and-one fold." (p. 35)*

The problem relevant to our discussion is Adler's use of personal experience. That Adler was a professional psychoanalyst does not mean that his experiences are automatically valid. A moment's thought will reveal the limitation of personal experience. Adler was a therapist and treated people suffering various psychological problems. His patients were hardly representative of the general population, and, therefore, not the foundation for a comprehensive theory of personality development that describes all people. The Idols of the Cave refers to the fact that we too often depend on our personal experiences to determine why things happen as they do. As we will soon see, we must do more than merely rely on personal experience to develop scientific explanations. *Why might this be a problem for scientific research?*

Idols of the Marketplace

The third bias that Bacon examined involves our use of language. Turning to Bacon (1620/1994), we read, "The *Idols of the Market-place* [*sic*] are the most troublesome of all; these are idols that have crept into the understanding through the alliance of words and names" (p. 64). Bacon recognized that our use of words shapes how we think about things. Consider an example related to day care for children. Scarr, Phillips, and McCartney (1990) noted that during the 1950s and 1960s, developmental psychologists who studied the effect of child care examined the effects of *maternal absence* or *maternal deprivation.* Clearly, these emotionally charged phrases create a negative bias against women who choose to pursue a career while their children are infants and toddlers. Why use these phrases as if the mother deprived her children of food and water? What about the father's absence? If children suffer *maternal deprivation,* why don't they suffer *paternal deprivation* as well? Could it be that fathers are guilt-free because societal norms allow men to work outside the home? Furthermore, the words *absence* and *deprivation* evoke images of children warehoused in dangerous day-care centers. Scarr and her colleagues argued that these terms grew out of "fantasies about child development . . . mother-infant attachment . . . and the role of early experience for later development" (p. 255). These terms fell out of favor during the 1970s, when the rights of women to pursue a career became popular. Researchers then began to examine the benefits of day care. Thus, the Idols of the Marketplace reflect the power of language over our thought processes. *How could this be a limitation to good science?*

Idols of the Theatre

The last of Bacon's idols represents the effects of our education. Here we find Bacon (1620/1994) complaining that many of the things we learn may mislead us. "The *Idols of the Theatre,* on the other hand, are not innate, nor are they secretly insulated into the understanding, but are imposed and received entirely from the fictitious tales in theories, and from wrong-headed laws of demonstration" (p. 66). In other words, the Idols of the Theatre are illustrated any time we accept an explanation without critically evaluating it first. In many cases, we automatically accept certain explanations because we learned them from someone we trust or see as an authority figure. Countless "scientific" theories have enjoyed this kind of dubious honor, including the now-debunked notions that the earth is the center of the universe and the world is flat. Apart from these seemingly ancient ideas, commonly accepted notions are all around us. Perhaps the best illustration of this is in Kohn's (1990) book on popular beliefs, in which he describes various common beliefs and their fallacy, including "No pain, no gain," "Competition builds character," "Like father, like son," and "Playing hard to get makes one more attractive."

A classic example of this bias can be found in Garcia's (1980) research on taste aversion. His experiments on taste aversion revealed that several well-established principles of classical conditioning were not accurate. Unfortunately, many psychologists did not accept Garcia's conclusions because the results contradicted the prevailing theories of classical conditioning. Garcia found it difficult to publish his papers in scholarly journals, and many reviewers ridiculed his work. In retrospect, Garcia's research has had a monumental effect on our understanding of classical conditioning principles. The defining characteristic of the Idols of the Theatre is our tendency to accept the truth of a statement without criticism. The best defense against this source of bias is simply to always think critically about what someone is asking you to believe. *Why can this be a problem?*

Bacon's Legacy

Bacon's primary legacy is that he clearly identified the obstacles to critical thinking as they apply to science even today. Although the scientific method has been around for 400 years, the effects of his idols remain. Each of us can fall prey to the idols. Studying Bacon will help you understand why researchers use specific tactics when conducting their research. Researchers use research methods and statistics to overcome many forms of bias. By studying Bacon, you will learn that you can never become complacent with your knowledge. The lesson we can learn from Bacon is that the Idols of the Tribe, Cave, Marketplace, and Theatre are always present, and we guard against these biases whenever we utilize the scientific method to study and explain the behavior of people. Take some time to review Table 1.1 and think of examples of Bacon's idols.

Other Important Historical Figures

The goal of this text is not to provide you with a history of science or a comprehensive listing of individuals who have influenced scientific thought. However, a brief review of two additional individuals (Gustav T. Fechner and John B. Watson) will help to illustrate the development of

Table 1.1 **Review of Bacon's Idols**

Idols of the Tribe	Biases due to overreliance on common sense and the tendency to make errors in logical reasoning.
Idols of the Cave	Biases due to dependence on personal experience to explain why things occur the way they do.
Idols of the Marketplace	Biases due to how we use specific words to describe things.
Idols of the Theatre	Biases due to uncritical acceptance of explanations that people in authority tell us are true.

current views of research methods. Many other individuals could be listed and discussed here. It is no coincidence that both Fechner and Watson were picked for this discussion. Both contributed directly to the development of experimental psychology as a scientific field of study. Considering that all of the authors of this text are psychologists, this could be viewed as an example of one of Bacon's idols at work. Which of the idols do you think fits best in explaining this?

On October 22, 1850, *Gustav T. Fechner* (1801–1887) invented experimental psychology by discovering a way to measure mental events. All science relies on measurement, which is nothing more than assigning numbers to observations. All sciences have specific methods for measuring the phenomena they study. However, before October 22, 1850, psychologists had no objective method for measuring mental events. Fechner studied physics and human perception. In his research, he observed that there was not a one-to-one relation between the intensity of a stimulus and our perception of the stimulus. For example, imagine a friend asks you to hold out your hand and close your eyes. If your friend puts a pencil on your hand, you will notice its weight. Now imagine your friend putting this textbook on your hand. You will feel the weight of the book. What if your friend then places the same pencil on top of the book? You will probably not be able to detect the additional weight. Why are you able to feel the weight of the pencil in one situation but not the other?

Fechner reasoned that by studying the relation between changes in the intensity of a stimulus (a physical event) and changes in a person's perception (a mental event) he could study how the mind works. He then proceeded to conduct a series of famous experiments that we now recognize as the start of *psychophysics*. Fechner's experiments may not sound like the most exciting thing that you learned today. Nevertheless, his work is very important because it caused people to recognize that it is possible to study mental events using empirical techniques. Soon after Fechner published his work, other researchers began to study psychological processes. For instance, upon reading Fechner's book, Hermann Ebbinghaus began to conduct his famous research on memory. It did not take long until the science of psychology became common practice.

John B. Watson (1878–1958) is another important person in the history of psychology. In 1913, Watson wrote an influential paper titled "Psychology as the Behaviorist Views It." The paper began with the proclamation, "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" (p. 158). This statement seems obvious now, but the historical relevance of Watson's paper is that he wrote his paper at a critical moment in the history of psychology, and his comments about the purpose of psychology did much to shape how psychologists now study psychological processes (Murray, 1983).

At the start of the twentieth century, psychology was a young science, and psychologists were searching for the best methods to conduct scientific research. At the time, many psychologists used a procedure known as

introspection. *Introspection* means to examine or look within. Whenever you think about your own thinking and mental events, you are using a form of introspection. Try this experiment in introspection: What reactions do you have when you read the word *mother*? Although introspection can be revealing, it has several shortcomings. Take a moment to think of a few.

Perhaps the most troubling question is, *How do we know that the self-report is accurate?* When you are asked to introspect about something, will you report everything that occurs to you? Is it possible that thinking of your mother evokes a painful memory that you do not want to share? How complete is your report? Although you may report things of which you are aware, could there be reactions that you did not recognize as important and worthy to share with others? Is it possible that there are unconscious mental processes that you do not directly experience? Psychologists' use of introspection troubled Watson because there is no way to verify the accuracy of an introspective report. The problem with introspection is that only one person can *experience or observe* your mental events—you. In science, researchers want to examine phenomena that others can see when they use the same procedures.

There are other problems with introspection. To what extent does your introspection influence the mental events you wish to study? Does thinking about your thinking affect your thinking? Are you confused? Try another thought experiment. Can you read and introspect about the process of reading at the same time? If you are like us, reading for content while introspecting is impossible. As soon as we start examining the process of reading, we are no longer reading. When we read for content, we cannot introspect. What are some other problems with introspection? Can you ask an infant to introspect? Can children ages 7 or 8 provide objective observations of their mental events? What about a person with depression or schizophrenia; will their introspections be accurate? If introspection requires objective and knowledgeable self-analysis, then we cannot use introspection to study children, people with severe psychological disorders, or animals. Watson (1913) rejected introspection as a research tool and recommended that psychologists study behavior exclusively. He believed that by focusing on behavior, psychologists could engage in the objective study of all living creatures. For Watson, if you can observe the behavior, then you can conduct scientific research.

Watson's legacy to psychology is that he focused our attention on behavior. Watson has had a lasting impact on all research involving the study of behavior and social interaction. Many researchers today subscribe to the perspective of **methodological behaviorism**, a philosophical stance evolving from Watson's beliefs. Methodological behaviorism suggests that researchers should study overt and observable behaviors as the primary focus of their research. Researchers use observable behaviors to make inferences about the emotional, cognitive, and other mental processes that occur within a person. As you will learn in this and other courses, behavior is the focal point of research in the social sciences. A developmental psychologist examining the memory of infants will conduct experiments

that examine the infants' behavior. A social psychologist examining altruism examines behavior. A clinical psychologist who studies depression also examines behavior. A criminologist may look at the behavior of prisoners. An economist may look at the behavior of rational or irrational investors. Following Fechner's and Watson's lead, we use the observable behavior of individuals to make inferences about various mental or cognitive events.

Assumptions of Science

Underlying everything we have discussed so far are two core assumptions that can be found built into any good research study. All sciences make the same basic assumptions about their subject matter. Social scientists take these assumptions to be true and use them to justify their use of the scientific method to study behavior.

Behavior Is Determined

Our first assumption is quite possibly the most important. We believe that behaviors are caused or triggered by specific factors. This perspective is known as **determinism** and someone who believes this (that all behaviors have a knowable set of causes) can be referred to as a *determinist*. You will learn that almost all researchers are determinists of one form or another. Sigmund Freud (1856–1939), for example, was a *psychical* determinist because he believed that human behavior reflected a series of unconscious drives and motivations. He believed that there are no accidents of behavior—everything we do reveals something about our character and unconscious drives.

By contrast, B. F. Skinner (1904–1990) was an *environmental* determinist because he believed that an individual's interaction with the environment produces changes in behavior. Other researchers are *biological* determinists because they believe that biological processes control many behaviors. Finally, some researchers are *sociocultural* determinists because they believe that cultural traditions, customs, and regulations control people's lives. When you examine different fields of study, such as human development, social behavior, abnormal behavior, or psychophysiology, you will find that researchers in each area conduct research to find the things that determine behavior. Regardless of their perspective, each type of determinist believes that by observing behavior and the surrounding conditions we can infer the causes of the behavior.

Some people object to determinism and suggest that human behavior is subject to **free will.** The principle of free will states that a person's soul or mind controls how he or she acts. Many religious faiths and philosophy theories suggest that humans are special because we have a spirit and self-awareness that guides us through life. These religions also teach us that we have the freedom to choose between the good and virtuous, or the evil and sinister. Thus, at first glance it appears that there

is quite a contrast between determinism and free will. Belief in determinism holds that we can explain observable behaviors by looking for and examining material causes. By contrast, belief in free will holds that each person is unique and that we cannot use the scientific method to understand human behavior.

It is not helpful to pit determinism versus free will. If you are willing to accept that people share some basic characteristics, then you will find that the scientific method does a good job of finding the causes of those common behaviors. Science does not have all the answers to important questions. Science, religion, philosophy, literature, and the arts are all different ways of knowing and experiencing our world. Each answers a unique set of questions using a different perspective. As Gould (1999) noted, science and religion are two ways of knowing. Both are equally important, yet both answer different questions. Taking a scientific perspective allows us to understand how things work, and when studying human behavior this means trying to discover why people do what they do. Religion helps us to examine our values and discover how we should behave. For many people, science and religion are not competing forces, but rather complementary methods for addressing different issues of importance. In the same vein, determinism and free will can be viewed as complementary and not always competing views.

We Can Measure the Critical Variables

A second assumption of science is that we can directly or indirectly observe the important causes of behavior. All sciences rest on a foundation of measurement. Fechner's insights allowed psychology to become a science because he realized that we could use a person's behavior to make inferences about mental events. Physicists, chemists, and other scientists routinely use observable events to make inferences about the existence of things that they cannot directly observe. For example, no one has seen gravity, only its effects. Nevertheless, physicists can use the motion of the planets and stars to infer that there is gravity and to describe its effects. We as social scientists often study behavioral events and situations to make inferences about interpersonal and intrapersonal events that we do not fully understand and perhaps cannot directly observe.

Requirements for Scientific Research

Now it is time to focus on specific elements of research that when combined allow us to "be scientific" when doing research.

Empirical Analysis

Empirical analysis involves the gathering of data by observation and experimentation with the goal of learning something. One important

characteristic of empirical analysis is that it involves **measurement**, or the converting of observations into numbers. There are many different types of measurement, but just about all can be grouped as either self- or other-observation, in which we use our own senses or someone else uses his or her own senses to collect information on how we interact with our environments.

Empirical methods are not the only way to gain insight into challenging questions. Within the social sciences, just about everything we "know" has come from scientists' efforts to observe and experience the phenomena of interest. Contrast this method with other ways of knowing. Mathematicians, for example, do not use empirical analysis, but instead discover new ideas using deduction and formal proofs. Here is an example of the difference between the empirical method of knowing and the mathematical way of knowing. Imagine that you have 10 quarters in your hand and toss them in the air. What is the probability of obtaining 0, 1, 2, 3, . . . or 10 heads? There are two ways of finding the answer. The first method is empirical. You would toss the 10 coins, count the heads, and then repeat these steps several thousand times until you had enough samples to make a relatively accurate conclusion about the probability of each outcome. You will eventually come to the correct answer, if you are willing to spend the hours of drudgery tossing and counting coins.

The second method uses deductive logic and analytical techniques. If you know enough about probability theory and your way around mathematical proofs, you can derive an equation that gives you the correct answer. There is nothing wrong with either method, although most people find the mathematical solution more elegant and convenient. There are many times, however, when the analytical method does not work and the empirical method is the only alternative. We can use mathematics to solve the coin problem because we know several critical things to be true, such as the fact that each coin has a 50% chance of landing heads. From these facts, we can derive additional truths. Thus, the deductive method works well when we have the necessary information before us to solve a problem. *In many cases we do not have this information.* Consequently, we must go about gathering data so that we can answer the question. In other words, empirical and deductive methods both have strengths and weaknesses.

The following is an example that illustrates the potential weakness of sole reliance on deductive logic:

1. All psychologists are human.
2. We are all psychologists.
3. Therefore, we must all be human.

Although extremely simple, this example illustrates a categorical syllogism that contains two premises (Statements 1 and 2) and a conclusion (Statement 3). In deductive logic, if we accept the premises and use the

appropriate rules of logic, then the conclusion is true. Now consider the deduction:

1. All unicorns are purple.
2. Annie is a unicorn.
3. Therefore, Annie is purple.

The conclusion about Annie's color is logically consistent if we accept the premises. This example illustrates a potential problem with finding answers by deductive logic or pure reason. If we accept the premises of an argument, then we must accept the truth of logically consistent conclusions. In the example of the unicorn, the conclusion is valid although it has no bearing in truth—unless you can find a living purple unicorn. Sir Francis Bacon and many others recognized that deductive logic can lead to erroneous conclusions based on a false or unproven premise. Consequently, scientists who utilize empirical methods attempt to verify the truth of premises with gathered data. In other words, if we can obtain observable evidence that unicorns exist and are purple, *then* we can conclude that Annie is purple.

Public Verification

Public verification is another important feature of empirical research. Using the empirical method requires us to rely on our senses when gathering data. If we design our research so that it can be publicly verified, then we are measuring things in a way that others can replicate with similar results. Therefore, public verification implies that anyone who uses the same procedure should be able to observe the same general outcome. Watson (1913) emphasized this requirement of good science when he called for all psychologists to drop introspection and adopt the study of behavior. Studying your own mind is fine, but this pretty much ensures you will be the only researcher who can experience your thoughts and make your observations. In other words, your mental events would not be subject to public verification. Your behavior and actions, however, are things that can be observed by anyone. Using a video camera, we can record your interactions with friends and family members and any researcher can share those observations. We can also attach sensors to your body and monitor your heart rate, the sweat on your palms, and the electrical activity of your brain. We can give you a personality test as a way to measure how you perceive yourself. In each case, we have collected public information that others can verify. Public verification also means that anyone with the appropriate equipment can repeat an experiment. This facet of public verification is extremely important. Our ability to repeat or replicate experiments gives us greater confidence in the general applicability of our results. The more times we can repeat an experiment and obtain similar results, the more likely we are to agree that an effect we observed is real and not just a fluke, due to chance.

Systematic Observation

Systematic observation refers to the way we go about collecting information. Whenever we collect data, we want to make our observations under specific conditions, as we attempt to rule out alternative explanations for the outcomes we might be observing. Imagine that a psychotherapist claims that a new form of therapy helps depressed people. Although this claim sounds great, we need to determine its truth. We can do this using systematic observation. For example, we should determine whether the treatment produces better results than could be achieved with no treatment or a placebo treatment. To do this study, we could subject a large sample of depressed people to one of three conditions: no treatment, a **placebo** treatment, and the new therapy.

In this example, the systematic observation comes into play as we measure differences in our participants' levels of depression under each of the three different treatment conditions. Another way that we can use systematic observation is to compare the new therapy to other current psychotherapies being used by other clinicians. For this type of research, we want to determine whether the therapy is in some way better than other forms of therapy. Yet another way to use systematic observation is to determine whether the therapy works better with some people than others. Thus, we would conduct studies comparing the differences among men and women; children, adults, and the elderly; or people who are or are not taking antidepressant medication.

The overarching goal of systematic observation is to examine a particular phenomenon under as many relevant situations as possible. We continue to repeat our observations and experiments to determine which conditions consistently produce the effect and what other possible factors aside from the treatment might influence the phenomenon. Unfortunately, many people do not recognize the necessity of systematic observation, tending instead to accept testimonials and/or personal opinions without question. **Testimonials** are not a form of systematic observation, although they are often treated as such. Testimonials are nothing more than an example of Bacon's Idols of the Theatre. When people make a claim like this, we are supposed to believe what they say. Testimonials are also an example of the Idols of the Cave because they reflect personal experience. Watch any infomercial on television and you will hear many happy customers share their personal experiences with the product: "My life was really going nowhere fast until I enrolled in Research Methods. Now I'm 'the king of the world!'" Good researchers shy away from putting too much emphasis or weight on testimonial claims that are neither systematic nor objective. *How does this help them conduct better research?*

Control of the Environment

In all forms of research, we attempt to exercise **control of the environment** in some way. We do this to ensure that the conditions in which we make our observations are consistent and can be replicated by other researchers who

might wish to verify our findings. Researchers have the greatest level of control when they conduct research in a laboratory setting because they can control many or all external environmental conditions. This control helps to reduce the number of possible factors that might influence a participant's behavior, thoughts, or feelings. There are many cases, however, in which direct control of the research environment is not possible. This is especially true when a **field study** is being conducted, but even here a true researcher will try to ensure as much as possible that the environment is the same each time he or she collects data from that sample.

Rational Explanation

A **rational explanation** refers to the two basic assumptions of science: (1) behavior is determined and (2) behavior follows a lawful pattern that can be studied. Rational explanations of behavior, therefore, include two essential components. The first is that the explanation refers only to causes that one can observe or confirm through public verification. The second is that the explanation makes a clear and logical link between the cause and effect. Explanations that are not rational are not scientific. Instead, these are typically called **pseudoexplanations** because although they may sound like sophisticated explanations of some phenomenon, they do not improve our understanding in any way. A pseudoexplanation is also commonly referred to as a **nominal fallacy** or a **tautological** or **circular explanation**, referring to the tendency to use the phenomenon to define itself. Thus, a pseudoexplanation is an example of the Idols of the Tribe, as it appeals to our desire for commonsense explanations.

For example, a typical early definition of a *reinforcer* was *a stimulus, produced by a behavior, that increases the probability that the individual will repeat the behavior.* This explanation is circular because there is no independent definition of the reinforcer. The definition uses the effect of reinforcement to define the property of reinforcement. Why is this technique a problem? Consider the following exchange:

> Question: "What is a reinforcer?"
> Answer: "A reinforcer is anything that increases the probability of a behavior."
> Question: "How do we know that something is a reinforcer?"
> Answer: "Because it increased the probability of a behavior."
> Question: "Why did the probability of the behavior increase?"
> Answer: "Because we used a reinforcer."
> Question: "But what is a reinforcer?"

The problem with this cycle is that we have no way of defining the reinforcer without referring to the behavior it affects. In other words, this type of definition tells us nothing about why a reinforcer works. Using the definition of reinforcement does not allow us to predict what things will serve as effective reinforcers. This definition also does not explain why a reinforcer will increase the probability of reinforcement.

Fortunately, David Premack (1959, 1965) discovered that high-frequency behaviors can reinforce low-frequency behaviors (the Premack principle). The advantage of this definition is that it breaks the circular definition, defining the cause as independent from the effect. More specifically, Premack's theory states that any high-frequency voluntary behavior will reinforce a low-frequency voluntary behavior. According to this definition of reinforcement, we can take several behaviors and categorically predict which will and will not be reinforcers. Consider this example: "For Alex, playing video games is a high-frequency behavior and studying math is a low-frequency behavior. Therefore, playing video games will serve as a reinforcer for studying math." We predict that video game playing is a reinforcer because it is a high-frequency behavior. We can then verify this hypothesis with an empirical test by allowing Alex to play video games only if he spends more time studying math. If there is an increase in the amount of time spent studying math (the effect), we can then say that the reinforcement (playing video games) caused the change.

Another feature of a rational explanation is that a researcher can empirically test and determine whether an explanation is correct. What if your professor told you that there is a special energy force that affects the brains of some people and causes them to be schizophrenic? The first question you should ask is, "Where's the empirical evidence?" What if the professor told you that no known apparatus can detect the radiation? At this point, you should realize that your professor is either losing his own mind or offering you a classic pseudoexplanation. A better explanation is one that is objectively defined in a way that can be supported with observational data by you and other researchers who may wish to replicate your work. Indeed, many researchers have tested the accuracy of the Premack principle. Some have verified Premack's predictions, whereas others have not (Mazur, 1998). Using the results of these experiments, Timberlake and Allison (1974) were able to refine Premack's definition and offer a more comprehensive definition of reinforcement.

Parsimonious Explanation

In addition to being rational, scientists strive to make explanations *parsimonious*. **Parsimony** means simplicity. If you have difficulty remembering this concept, try to link it in your mind visually to a big fat kiss and remember that that kiss represents the "Keep It Simple, Stupid!" principle. In the present context, a scientific conclusion or explanation is parsimonious if it makes relatively few assumptions, does not refer to unobservable causes, and refers to specific causes. This requirement is also known as **Occam's razor.** Consider an example from the history of psychology. For a long time, psychologists who followed Freud believed that schizophrenia resulted from severe conflict within a person's unconscious stemming from psychological abnormalities in the person's development.

Now, many psychologists believe that much of schizophrenia reflects imbalances in various neurotransmitters in the brain. This biological

account of schizophrenia is more parsimonious than Freud's because of the number of assumptions and unobservable constructs that the latter theory requires. Freud's theory depends on a large number of intrapsychic processes (e.g., id, ego, and superego) as well as a host of other conditions such as the "schizophrenicgenic mother." Psychologists cannot measure these constructs objectively. By contrast, the biological theory is relatively parsimonious because its states that schizophrenia results from imbalances in specific neurotransmitters. Researchers can measure these neurotransmitters and regulate them with medication. Furthermore, regulation of these neurotransmitters corresponds with changes in a person's schizophrenic symptoms. Please realize that we are *not* saying that simplicity automatically makes a theory correct. Instead, a parsimonious theory allows for specific predictions that researchers can directly test. Its value to science is its ability to generate many ideas for specific research projects.

Tentative Explanations

Whenever a researcher presents the results of a study, the explanation of the results is **tentative.** No single study can account for all the potential explanations of the results. You can think of any single study as a small step in a long journey. Although each step may take us closer to our goal, it may also take us in the wrong direction. Consider the previously mentioned biological theory of schizophrenia. Although the theory is useful, it is not complete. Researchers recognize that schizophrenia is a complex set of behaviors that requires careful analysis. Although the neurotransmitter theory is useful, psychologists who study schizophrenia continue to look for additional explanations for this disorder.

As you read more about psychology, you will learn that researchers are continually revising their explanations for why things work the way they do. The change occurs because each study adds new information. Some new information may confirm what we already know and so we continue to use the theory to explain the phenomenon we study. Other new information, however, may indicate that the theory cannot account for specific events and must be revised or replaced. Therefore, psychologists recognize that explanations of behavior are as good as the data they have collected. Researchers recognize that as new data are collected, they may have to revise their explanations or develop new explanations.

Now that we have reviewed the general tenets of experimental psychology, we can look at a practical application of research methods in psychology. The following example illustrates the errors that people can make when they do not use the scientific method to examine a problem. In addition, the example shows how the scientific method can resolve a serious controversy.

Research in Action: The Case of Facilitated Communication

Autism is a distressing condition. Children with autism are withdrawn and do not show normal signs of social or cognitive development. Raising an

autistic child is challenging because the child requires exceptional patience and much attention. Although there are many treatments for autism, these programs are time consuming and expensive. Several years ago, a new procedure called *facilitated communication* became popular among people who treat autism. The theory behind facilitated communication is that people who have autism have unique mental barriers blocking their normal communication (Biklen, 1990). According to Biklen, a person with autism can communicate better with the help of a trained facilitator. The person with autism uses a keyboard to type messages. The facilitator helps by holding the autistic person's hand or arm. Biklen believed that the physical contact of the facilitation helps the autistic person focus his or her thoughts and express them through the keyboard. Although the facilitator holds the client's hand or arm, they claim that they do not influence what the child types.

Facilitated communication quickly became a popular treatment for people with autism. Many therapists attended seminars where they learned to become certified facilitators. Several schools and residential facilities incorporated facilitated communication into the treatment programs for their clients. Those who used facilitated communication often gave vivid and emotional testimonials of how facilitated communication was a god-send. Parents discovered that after many agonizing years they could finally communicate with their children. Teachers discovered that their autistic students were bright and talented people. By all accounts, facilitated communication appeared to break through the barriers of autism and liberate the person within. Although facilitated communication appeared to be a phenomenal treatment for autism, several researchers were skeptical (e.g., Hudson, Melita, & Arnold, 1993; Montee, Miltenberger, & Wittrock, 1995; Moore, Donovan, & Hudson, 1993; Wheeler, Jacobson, Paglieri, & Schwartz, 1993). These skeptics began to ask critical questions regarding the claims about facilitated communication and suggested the need for controlled experiments to determine whether facilitated communication worked.

Why is skepticism important in science? Sometimes skeptics seem to be more of a nuisance than anything. Skeptics seem to ask questions for the sake of asking questions and dismiss what seems to be a good thing. Despite these characterizations, skepticism is essential in science as it helps to ensure that we are not tricked into believing in something that is not true. Why was it important to test the claims of facilitated communication, especially if the children seemed to benefit from the treatment and the parents and teachers thought that the treatment worked? How would you go about determining whether facilitated communication allowed the child to communicate through the facilitator? How would you show that it was not the facilitator typing the child's responses? Facilitated communication appeared to work and showed that people with autism were bright individuals and could interact with others.

The problem is that perception can be deceiving. Just because people with autism appeared to communicate does not mean that the treatment

worked as advertised. The skeptics argued that facilitated communication needed to be tested under controlled conditions to rule out alternative explanations. When a scientist observes that a treatment works it is also necessary to ensure that that effect results from the unique characteristics of the treatment itself and not other factors. To accomplish this, Montee et al. (1995) conducted an experiment in which the facilitator and the autistic person sat at a table. On the table was a large T-shaped screen that kept the facilitator and the autistic person each from seeing what the other saw. The researcher showed both people pictures and asked the person with autism to type what he or she had seen. The facilitator then helped with the typing as he or she normally would. As an example, the researcher might show both people a photograph of a cat. We would expect that the autistic person would indicate that he or she had seen a cat or at least an animal. The real test came when each person saw a different photograph. For example, the facilitator may see a picture of a car and the person with autism may see a picture of a hamburger. Remember that the facilitator did not see the same picture that the autistic person saw and vice versa. The results of this test are critical. If the person with autism indicated that he or she saw a hamburger, a sandwich, food, or lunch, we would have evidence that the facilitated communication worked. However, if the person said that he or she saw a car, we must conclude that the person doing the typing was the facilitator, not the person with autism.

The results of these experiments were clear; the person doing the typing was the facilitator, not the person with autism. When the researcher presented different pictures, the response always corresponded with what the facilitator saw, not what the client saw. Montee et al. (1995) replicated the findings of many other studies that examined the validity of facilitated communication. These experiments used different pairs of facilitators and clients, different pictures, and different techniques for presenting the pictures. The results were the same, however. There was no convincing evidence that facilitated communication worked to help people with autism. Consequently, facilitated communication has lost favor among professionals in the field. A formal statement of the issues associated with facilitated communication as related to practicing psychologists can be found in a statement published (and available online) by the American Psychological Association (1994).

One of the most important lessons to be learned from this example is the importance of skepticism and empirical research. We cannot always take the results we receive at face value. This is, after all, the main reason for public verification and replication. At first glance, facilitated communication seemed to be a great intervention, and many people were quick to adopt the new treatment as a way of solving a longstanding problem. What would have happened if no one intervened and questioned the value of facilitated communication? How much money would people have paid for a treatment that did not work? How long would people with autism be deprived of treatment programs that really do work? Empirical skepticism determined the limitations of facilitated communication.

Chapter Summary

This chapter introduced you to research methods by briefly examining the history of science as it relates to research methods and by offering an overview of the meaning of scientific research. The goal of this chapter was to illustrate that studying research methods is an important component of any student's education, especially students in the behavioral sciences. Researchers use the scientific method to conduct basic research to understand various behavioral phenomena. Research methods also have many practical applications. Regardless of your current or future career objectives, it is important to understand the foundations of science and research methods.

Sir Francis Bacon was an early advocate of empirical science. He believed that the scientific method would overcome several human tendencies that are obstacles to a better understanding of our world. He called these tendencies *idols* and identified four specific ones: *Idols of the Tribe* (common modes of thought that lead to irrational conclusions), *Idols of the Cave* (overreliance on personal experiences), *Idols of the Marketplace* (biases in beliefs based on the meaning and use of words), and *Idols of the Theatre* (biased thought based on tradition, habit, or deference to authority).

We credit Gustav T. Fechner as the first experimental psychologist because on October 22, 1850, he recognized that researchers could indirectly observe or make inferences about mental events by observing reactions to physical stimuli. John Watson's contribution to research was his insistence that behavior is the proper target of research and that introspection is not a useful procedure for science. The objective study of behavior allows researchers to understand behavioral and cognitive phenomena. Therefore, many researchers in the behavioral and social sciences are methodological behaviorists.

Researchers believe that they can use the scientific method to study behavioral and cognitive phenomena. They base this belief on the assumptions that the behavior they study is determined by specific causes that can be measured. Scientific research, regardless of the discipline, has several general characteristics:

1. Empirical analysis is the process of learning through observation and experimentation and through quantifying observations.
2. Public verification requires that we conduct research that can be repeated by others and specifically that the variables we examine can be observed by everyone.
3. The systematic observation criterion requires us to make our observations under various conditions or settings.
4. Control of environment refers to our ability to conduct our research under consistent conditions. When researchers explain various

phenomena, they also attempt to make their explanations rational, parsimonious, and tentative.

5. The rational explanation means the terms are clearly defined and can be independently assessed and defined.
6. Parsimonious explanations are specific, make few assumptions, and generate many testable ideas. Pseudoexplanations, by contrast, are circular in definition and cannot be directly or objectively assessed.
7. Explanations are tentative. Researchers recognize that their explanations must be revised in the face of additional research.

In the final section of the chapter, we examined the case of facilitated communication. This example illustrates what can happen if we casually and uncritically accept claims about human behavior. The example also illustrates how empirical research can demonstrate the value of a therapy.

Knowledge Check

1. Describe an area of psychology that you find most interesting. How does the scientific method help researchers better understand this area of psychology?
2. Psychology is not the only discipline that examines human behavior. The authors of many great novels write about the human condition and use their stories to describe why people behave as they do. Describe the difference in perspective between a psychologist and the author of a novel.
3. Many people believe that professional athletes have moments when they are "in the zone," during which their performance is greatly enhanced. There are also times when the athlete will be "in a slump." By contrast, statisticians argue that these phases do not exist and are nothing more than random events. Which of Bacon's four idols best describes the belief that athletes are in the zone or in a slump?
4. You want to buy a new car. A friend of yours, an auto mechanic, says, "Stay away from that car, my shop is always filled with them. I plan to send my kids through college on the work that model makes for me." How does this example relate to Bacon's Idols of the Cave?
5. Imagine that Gustav Fechner and John Watson are alive and meet for a conversation. In what ways would they agree that psychology is a science?
6. Describe the meaning of introspection and why Watson objected to its use in psychology.
7. Jean Piaget was a famous psychologist who studied the cognitive and intellectual development of children. For much of his research, he asked children of different ages to solve logical problems. Can we

consider Piaget to have followed the perspective of methodological behaviorism?

8. Use the example of facilitated communication to explain why we cannot depend on testimonials to evaluate an empirical claim.
9. Using the example of facilitated communication, show how researchers used (a) empirical analysis, (b) public verification, (c) systematic observation, and (d) control of the environment to question the validity of facilitated communication.

Use the following scenario to answer questions 10 and 11: Imagine that your friend believes that he has psychic powers. He claims that he can often guess what another person is thinking. Two of your other friends agree and claim that there have been several times when your friend has shown his psychic abilities. Given this information, respond to the following questions:

10. Why would you want to use empirical methods to confirm your friend's psychic abilities? Why not rely on the testimonials of your friends who are being honest when they say that your friend is psychic?
11. Your friend agrees to a test. You create a list of randomly selected common words. As you concentrate on the word, your friend tries to read your mind. He fails the test and is unable to guess any of the words. To explain the failure, he says, "Well you see, it only works when there is no doubt of my ability. You doubt my ability and that creates negative energy that blocks my ability to read minds." Based on what you read in this chapter, comment on your friend's reaction.
12. According to the text, what are the essential elements of scientific research? Describe how psychologists incorporate these in their research.
13. Contentment is a mental phenomenon that we cannot directly observe; yet it is a common experience. Describe how a psychologist might measure contentment and make it an observable phenomenon.
14. A therapist claims that he has developed a new therapy to treat aggressive children. You find several children who received the new therapy but still start fights with other children. The therapist states that the therapy works only when the child really wants to change his or her behavior. Comment on the therapist's reaction.
15. Why is public verification especially important for the science of psychology?
16. In an interview, a reporter asked a government official to explain why an accused computer hacker had broken into the government's high-security computers. The official replied, "The accused has an anti-social personality." Comment on the value of this response.
17. Would science exist if there were no measurement? Defend your answer.

Chapter Glossary for Review

Control of environment—A feature of empirical research. The researcher attempts to observe the phenomenon under identical conditions. Also implies that the researcher reduces the effects of distracting or nuisance conditions that will add confusion to the data.

Determinism—A philosophical stance that natural events and human behavior are the result of an orderly sequence of preceding events that can be predicted using fundamental scientific laws.

Empirical analysis—Using observation and research methods involving the gathering of data to help with identifying answers to research questions.

Field study—Research conducted beyond the boundaries of a laboratory, in an environment in which the phenomenon under study tends to occur or exist.

Free will—A philosophical stance that human behavior is independent of external causes and that humans are free to choose how they will act.

Gambler's fallacy—An example of the Idols of the Tribe. The fallacy is a belief that random events follow a predetermined pattern. For example, many people believe that for six tosses of a fair coin, the pattern THHTHT is more likely than TTTHHH; both are equally likely based on laws of probability.

Idols of the Cave—Bacon's phrase to describe the tendency to use one's personal experience as the foundation for truth or the measure of all things.

Idols of the Marketplace—Bacon's phrase to describe how our use of words shapes our perception of and reaction to things.

Idols of the Theatre—Bacon's phrase to describe the tendency to accept a theory or statement as fact and fail to question its accuracy or generality.

Idols of the Tribe—Bacon's concept to describe common errors in humans' thinking. These errors of thought are present, to varying extents, in all people and include overreliance on common sense and logical errors of reasoning.

Introspection—A process by which one attempts to analyze his or her own conscious experiences.

Measurement—The process of converting observations to numbers using a set of rules.

Methodological behaviorism—The belief that psychologists should study observable behaviors to conduct scientific research in psychology. By observing the conditions under which behavior occurs, one can then infer the causes of the behavior or the presence of mental processes that cannot be directly observed.

Nominal fallacy—An example of a pseudoexplanation that makes the erroneous assumption that naming a phenomenon is the same as explaining the phenomenon.

Occam's razor—A version of parsimony that requires that we do not create more distinctions among things than is necessary.

Parsimonious explanation—A requirement in science that we offer explanations that make the fewest assumptions and require reference to few or no unobservable phenomena.

Placebo—A false treatment condition in which participants are not exposed to any real stimulus, but rather an imaginary placeholder such as a sugar pill or glass of water. Useful as a means of creating a control group without the participant knowing he or she is not getting the real treatment.

Pseudoexplanation—An explanation of a phenomenon that does not really explain the phenomenon.

Public verification—The requirement that the subject matter of any empirical research must be observable to any person who uses the same procedures and equipment to examine the phenomenon.

Rational explanation—Offering a description or interpretation of a phenomenon that follows the rules of logic.

Self-fulfilling prophecy—An example of the Idols of the Tribe. People will act in ways that bring about the result(s) they expected in the first place.

Systematic observation—A process in which the researcher varies the conditions under which he or she studies a particular phenomenon.

Tautological (circular) explanation—A form of pseudoexplanation that involves circular definitions, which use the phenomenon to be described when trying to define its cause.

Tentative explanation—The recognition that all descriptions and explanations that arise from empirical research may be incomplete or inaccurate. Additional research may force us to revise our beliefs.

Testimonial—A statement that a person makes about the truth of a fact or a claim based on personal experience.

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