2 The Research Enterprise in Psychology

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- Does sleeping less than seven hours a day reduce how long you will live?
- Do violent video games make people more aggressive?
- Can you make better decisions by not deliberating about them?
- Can women judge men's testosterone level in just one glance?
- Do IQ scores predict how long people will live?

Questions, questions, questions—everyone has questions about behavior. Investigating these questions is what psychology is all about.

Some of these questions pop up in everyday life. Many a parent, for example, has wondered whether violent video games might be having a harmful effect on their children's behavior. Other questions explored by psychologists might not occur to most people. For example, you may never have wondered about what effects your IQ or sleeping habits could have on your life expectancy, or whether women can judge men's testosterone levels. Of course, now that you've been exposed to these questions, you may be curious about the answers!

In the course of this book, you'll find out what psychologists have learned about the five questions asked above. Right now I want to call your attention to the most basic question of all—namely, how should we go about investigating questions like these? How do we find answers to our questions about behavior that are accurate and trustworthy?

As noted in Chapter 1, *psychology is empirical*. Psychologists are committed to addressing questions about behavior through formal, systematic observation. This commitment to the empirical method is what makes psychology a scientific endeavor. Many people may have beliefs about the effects of playing violent video games based on personal opinion, a feeling of aversion toward violence, a generally permissive attitude toward children's games, anecdotal reports from parents, or other sources. As scientists, however, psychologists withhold judgment on questions like these until they have objective evidence based on valid, reproducible studies. Even then, their judgments are likely to be carefully qualified so that they do not go beyond what the evidence actually shows.

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Gathering and evaluating that empirical evidence is an exercise in creative problem solving. As scientists, psychologists have to figure out how to make observations that will shed light on the puzzles they want to solve—and stand up to the critical scrutiny of their peers. In this endeavor psychologists rely on a large toolkit of research methods because different kinds of questions call for different strategies of investigation. In this chapter, you'll learn about some of the principal methods used by psychologists in their research.

Why should you care about psychologists' research methods? There are at least two good reasons. First, having a good grasp of these methods will enhance your ability to understand the information you will be reading in the rest of this book, all of which is based on research. Second, becoming familiar with the logic of the empirical approach will improve your ability to think critically about claims concerning behavior. This ability is important because you are exposed to such claims—in conversations with friends, in advertising, in the news media—nearly every day. Learning how to evaluate the basis of these claims can make you a more skilled consumer of psychological information.

We'll begin our introduction to the research enterprise in psychology by examining the scientific approach to the study of behavior. From there we'll move to the specific research methods that psychologists use most frequently. We'll also see how and why psychologists use statistics in their research.

Scientific methods have stood the test of time, but individual scientists are human and fallible. For this reason we'll conclude our discussion with a look at some common flaws in research. This section alone can make you a more skilled evaluator of claims that are said to be based on psychological studies. Then, in the Personal Application, you'll learn how to find and read journal articles that report on research. Finally, in the Critical Thinking Application, we'll examine the perils of a type of evidence people are exposed to all the time—anecdotal evidence.

Key Learning Goals

2.1 Explain science's main assumption, and describe the goals of the scientific enterprise.

2.2 Clarify the relations among theory, hypotheses, and research.

2.3 Outline the steps in a scientific investigation.

2.4 Identify the advantages of the scientific approach.

Looking for Laws: The Scientific Approach to Behavior

Whether the object of study is gravitational forces or people's behavior under stress, *the scientific approach assumes that events are governed by some lawful order.* As scientists, psychologists assume that behavior is governed by discernible laws or principles, just as the movement of the earth around the sun is governed by the laws of gravity. The behavior of living creatures may not seem as lawful and predictable as the "behavior" of planets. However, the scientific enterprise is based on the belief that there *are* consistencies or laws that can be uncovered. Fortunately, the plausibility of applying this fundamental assumption to psychology has been supported by the discovery of a great many such consistencies in behavior, some of which provide the subject matter for this text.

Goals of the Scientific Enterprise

Psychologists and other scientists share three sets of interrelated goals: measurement and description, understanding and prediction, and application and control.

1. *Measurement and description.* Science's commitment to observation requires that an investigator figure out a way to measure the phenomenon under study. For example, a psychologist could not investigate whether men are more or less sociable than women without first developing some means of measuring sociability. Thus, the first goal of psychology is to develop measurement techniques that make it possible to describe behavior clearly and precisely.

2. *Understanding and prediction.* A higher-level goal of science is understanding. Scientists believe that they understand events when they can explain the reasons for the occurrence of the events. To evaluate their understanding, scientists make and test predictions called hypotheses. **A *hypothesis* is a tentative statement about the relationship between two or more variables. *Variables* are any measurable conditions, events, characteristics, or behaviors that are controlled or observed in a study.** If we hypothesized, for example, that putting people under time pressure would lower the accuracy of their time perception, the variables in our study would be time pressure and accuracy of time perception.

3. *Application and control.* Ultimately, many scientists hope that the information they gather will be of some practical value in helping to solve everyday problems. Once people understand a phenomenon, they often can exert more control over it. Today, the profession of psychology attempts to apply research findings to practical problems in schools, busi-

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nesses, factories, and mental hospitals. For example, a school psychologist might use findings about the causes of math anxiety to devise a program to help students control their math phobias.

How do theories help scientists achieve their goals? As noted in Chapter 1, psychologists do not set out just to collect isolated facts about relationships between variables. To build toward a better understanding of behavior, they construct theories. **A *theory* is a system of interrelated ideas used to explain a set of observations.** For example, using a handful of concepts, such as natural selection and reproductive fitness, evolutionary theorists in psychology attempt to explain a diverse array of known facts about mating preferences, jealousy, aggression, sexual behavior, and so forth (see Chapter 1). Thus, by integrating apparently unrelated facts and principles into a coherent whole, theories permit psychologists to make the leap from the *description* of behavior to the *understanding* of behavior. Moreover, the enhanced understanding afforded by theories guides future research by generating new predictions and suggesting new lines of inquiry (Fiske, 2004; Higgins, 2004).

A scientific theory must be testable, as the cornerstone of science is its commitment to putting ideas to an empirical test. Most theories are too complex to be tested all at once. For example, it would be impossible to devise a single study that could test all the many facets of evolutionary theory. Rather, in a typical study, investigators test one or two specific hypotheses derived from a theory. If their findings support the hypotheses, confidence in the theory that the hypotheses were derived from grows. If their findings fail to support the hypotheses, confidence in the theory diminishes, and the theory may be revised or discarded (see Figure 2.1). Thus, theory construction is a gradual, iterative process that is always subject to revision.

Steps in a Scientific Investigation

Curiosity about a question provides the point of departure for any kind of investigation, scientific or otherwise. Scientific investigations, however, are *systematic*. They follow an orderly pattern, which is outlined in Figure 2.2 on the next page. Let's look at how this standard series of steps was followed in a study of *naive realism* conducted by David Sherman, Leif Nelson, and Lee Ross (2003). Sherman and his colleagues wanted to investigate whether adversaries in political debates overestimate the gap between their views.

Step 1: Formulate a Testable Hypothesis

The first step in a scientific investigation is to translate a theory or an intuitive idea into a testable hypothesis. Sherman et al. (2003) noted that in heated disputes people seem to assume that they see matters as they really are—that their perceptions are objective and accurate—whereas their opponents' views must be distorted by self-interest, ideology, or some other source of bias. The researchers call this belief in one's own objectivity and opponents'

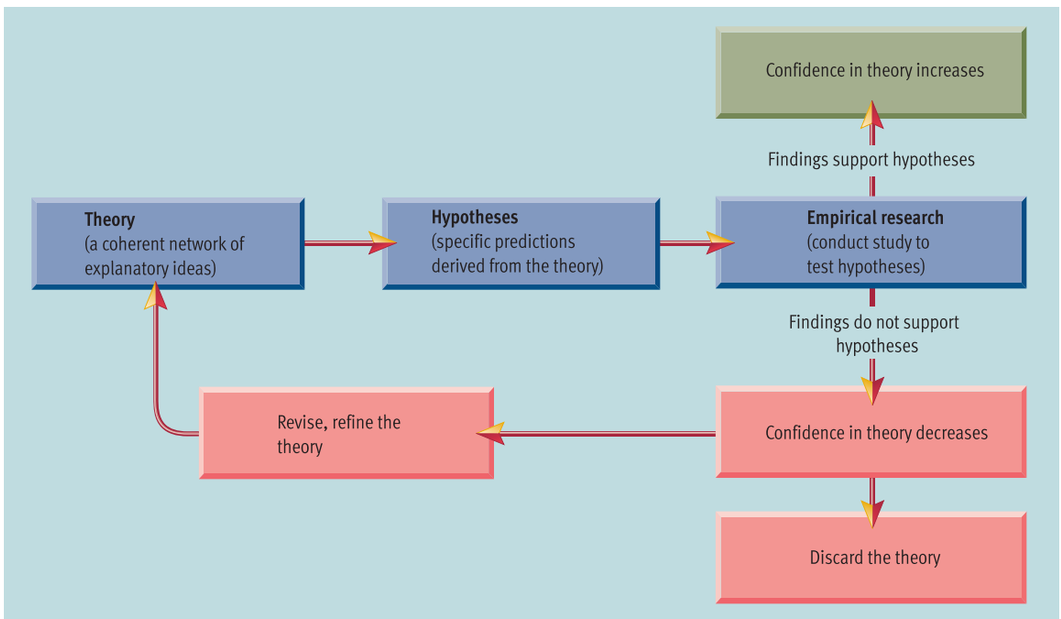

Figure 2.1
Theory construction. **A good theory will generate a number of testable hypotheses. In a typical study, only one or a few of these hypotheses can be evaluated. If the evidence supports the hypotheses, confidence in the theory they were derived from generally grows. If the hypotheses are not supported, confidence in the theory decreases, and revisions to the theory may be made to accommodate the new findings. If the hypotheses generated by a theory consistently fail to garner empirical support, the theory may be discarded altogether. Thus, theory construction and testing is a gradual process.**

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Table 2.1 Key Data Collection Techniques in Psychology

Technique	Description
Direct observation	Observers are trained to watch and record behavior as objectively and precisely as possible. They may use some instrumentation, such as a stopwatch or video recorder.
Questionnaire	Subjects are administered a series of written questions designed to obtain information about attitudes, opinions, and specific aspects of their behavior.
Interview	A face-to-face dialogue is conducted to obtain information about specific aspects of a subject's behavior.
Psychological test	Participants are administered a standardized measure to obtain a sample of their behavior. Tests are usually used to assess mental abilities or personality traits.
Physiological recording	An instrument is used to monitor and record a specific physiological process in a subject. Examples include measures of blood pressure, heart rate, muscle tension, and brain activity.
Examination of archival records	The researcher analyzes existing institutional records (the archives), such as census, economic, medical, legal, educational, and business records.

strategy that appears to be the most appropriate and practical. In this case, Sherman and colleagues decided that their question called for *survey* research, which involves administering questionnaires or interviews to people.

Once researchers have chosen a general method, they must make detailed plans for executing their study. Thus, Sherman and associates had to decide how many people they needed to survey and where they would get their participants. ***Participants,* or *subjects,* are the persons or animals whose behavior is systematically observed in a study.** For their first study, the researchers chose to use 78 undergraduates (45 women and 29 men) at Stanford University. They also had to devise a plausible-sounding affirmative action proposal that students could evaluate, and they had to craft rating scales that would permit the assessment of subjects' political ideology and their perceptions of their opponents' political ideology.

Step 3: Collect the Data

The third step in a research endeavor is to collect the data. Researchers use a variety of ***data collection techniques,* which are procedures for making empirical observations and measurements.** Commonly used techniques include direct observation, questionnaires, interviews, psychological tests, physiological recordings, and examination of archival records (see Table 2.1). The data collection techniques used in a study depend largely on what is being investigated. For example, questionnaires are well suited for studying attitudes, psychological tests for studying personality, and physiological recordings for studying the biological bases of behavior. Depending on the nature and complexity of the study, data collection can often take months, and it sometimes requires years of work. One advantage of the survey method, however, is that data can often be collected quickly and easily, which was true in this case. Sherman and his colleagues simply had their subjects complete a carefully designed questionnaire in exchange for a small nonmonetary gift.

Step 4: Analyze the Data and Draw Conclusions

The observations made in a study are usually converted into numbers, which constitute the raw data of the study. Researchers use *statistics* to analyze their data and to decide whether their hypotheses have been supported. Thus, statistics play an essential role in the scientific enterprise. Based on their statistical analyses, Sherman et al. (2003) concluded that their data supported their hypothesis. As predicted, they found that supporters of the affirmative action proposal greatly overestimated the conservativism of the rejectors and that the rejectors of the proposal greatly overestimated the liberalism of the supporters (see Figure 2.3). The data indicated that

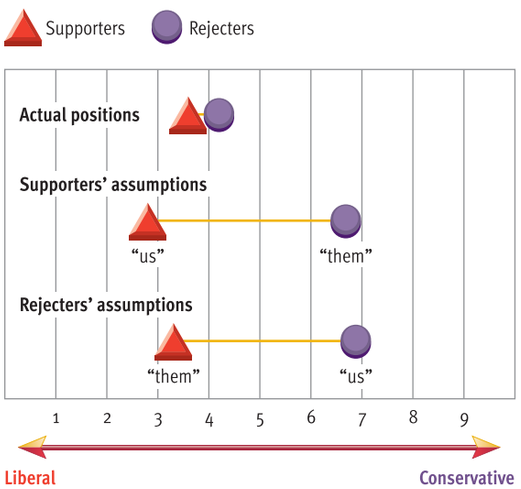

Figure 2.3
Results of the Sherman et al. (2003) study. **As you can see, the actual liberal-conservative positions of the supporters and rejectors of the affirmative action proposal were not all that far apart (top row). However, when supporters of the proposal were asked to estimate the average rating given by other supporters as well as those who rejected the proposal, they assumed that there was a huge gap between the two groups (middle row). Similarly, when those who were against the proposal were asked to make the same estimates (bottom row), they also overestimated the disparity between the two groups.**

SOURCE: Sherman, D. K., Nelson, L. D., & Ross, L. D. (2003). Naive realism and affirmative action: Adversaries are more similar than they think. *Basic and Applied Social Psychology, 25,* 275–289. Copyright © 2003 Lawrence Erlbaum Associates, Inc. Reprinted by permission.

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the actual (average) attitudes of the two groups were not all that far apart, but each group *assumed* that their opponents held very dissimilar views. Obviously, insofar as this may be true of political debates in general, it sheds light on (1) why it is often so difficult for opposing sides to bridge the (perceived) gap between them, and (2) why people often have such pervasively negative views of their adversaries.

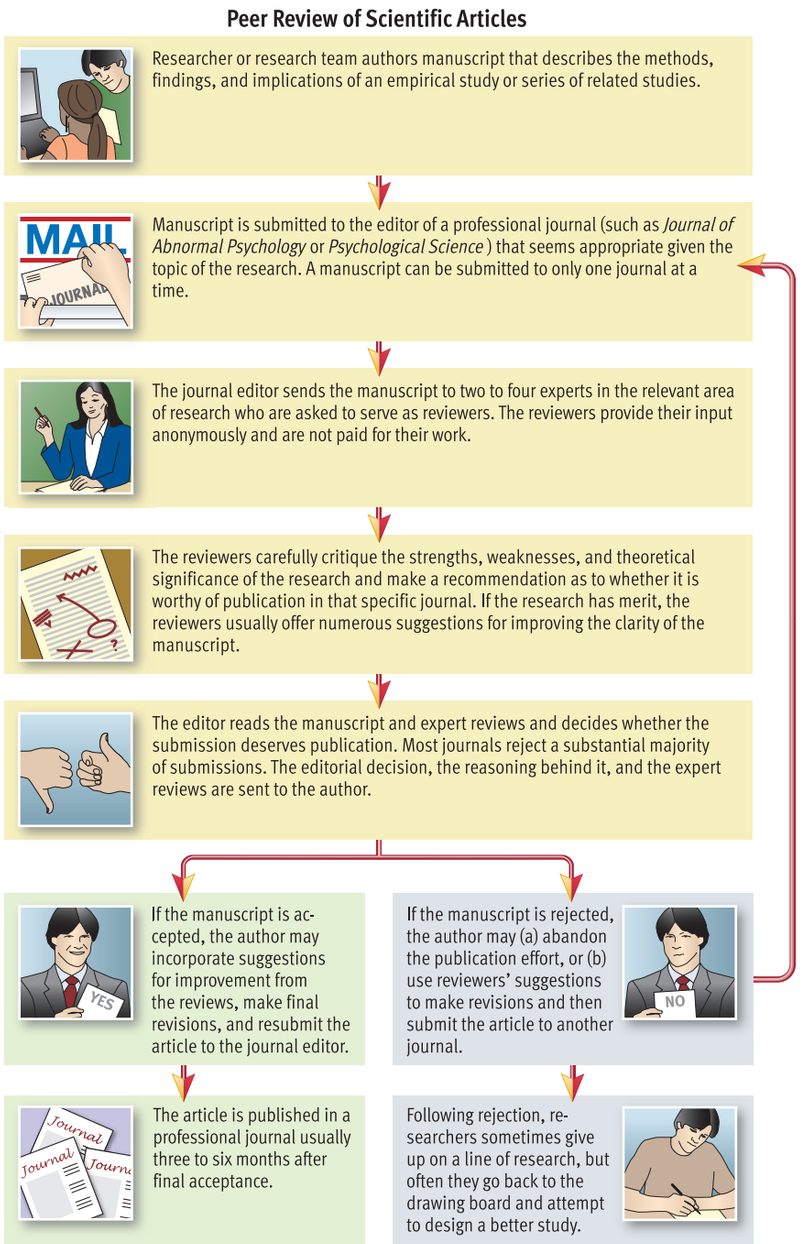

Figure 2.4

The peer review process for journal submissions. **Scientists use an elaborate peer review process to determine whether studies merit publication in a technical journal. The goal of this process is to maximize the quality and reliability of published scientific findings.**

Step 5: Report the Findings

Scientific progress can be achieved only if researchers share their findings with one another and with the general public. Therefore, the final step in a scientific investigation is to write up a concise summary of the study and its findings. Typically, researchers prepare a report that is delivered at a scientific meeting and submitted to a journal for publication. **A *journal* is a periodical that publishes technical and scholarly material, usually in a narrowly defined area of inquiry.** The study by Sherman and his colleagues was published, along with two companion studies, in a journal called *Basic and Applied Social Psychology.*

The process of publishing scientific studies allows other experts to evaluate and critique new research findings. When articles are submitted to scientific journals they go through a demanding *peer review process* that is summarized in Figure 2.4. Experts thoroughly scrutinize each submission. They carefully evaluate each study's methods, statistical analyses, and conclusions, as well as its contribution to knowledge and theory. The peer review process is so demanding, many top journals reject over 90% of submitted articles! The purpose of the peer review process is to ensure that journals publish reliable findings based on high-quality research. The peer review process is a major strength of the scientific approach because it greatly reduces the likelihood of publishing erroneous findings.

Advantages of the Scientific Approach

Science is certainly not the only method that can be used to draw conclusions about behavior. Everyone uses logic, casual observation, and good old-fashioned common sense. Because the scientific method often requires painstaking effort, it seems reasonable to ask what advantages make it worth the trouble.

Basically, the scientific approach offers two major advantages. The first is its clarity and precision. Commonsense notions about behavior tend to be vague and ambiguous. Consider the old adage "Spare the rod and spoil the child." What exactly does this generalization about childrearing amount to? How severely should children be punished if parents are not to "spare the rod"? How do we assess whether a child qualifies as "spoiled"? A fundamental problem is that such statements have different meanings, depending on the person. When people disagree about this assertion, it may be because they are talking about entirely different things. In contrast, the scientific approach requires that people specify *exactly* what they are talking about when they formu-

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late hypotheses. This clarity and precision enhance communication about important ideas.

The second and perhaps greatest advantage offered by the scientific approach is its relative intolerance of error. Scientists are trained to be skeptical. They subject their ideas to empirical tests. They also scrutinize one another's findings with a critical eye. They demand objective data and thorough documentation before they accept ideas. When the findings of two studies conflict, the scientist tries to figure out why, usually by conducting additional research. In contrast, common sense and casual observation often tolerate contradictory generalizations, such as "Opposites attract" and "Birds of a feather flock together." Furthermore, commonsense analyses involve little effort to verify ideas or detect errors. Thus, many "truisms" about behavior that come to be widely believed are simply myths.

All this is not to say that science has an exclusive copyright on truth. However, the scientific approach does tend to yield more accurate and dependable information than casual analyses and armchair speculation do. Knowledge of scientific data can thus provide a useful benchmark against which to judge claims and information from other kinds of sources.

Now that we have had an overview of how the scientific enterprise works, we can focus on how specific research methods are used. ***Research methods* consist of various approaches to the observation, measurement, manipulation, and control of variables in empirical studies.** In other words, they are general strategies for conducting studies. No single research method is ideal for all purposes and situations. Much of the ingenuity in research involves selecting and tailoring the method to the question at hand. The next two sections of this chapter discuss the two basic types of methods used in psychology: *experimental research methods* and *descriptive/correlational research methods*.

REVIEW of Key Learning Goals

2.1 The scientific approach assumes that there are laws of behavior that can be discovered through empirical research. The goals of the science of psychology include (1) the measurement and description of behavior, (2) the understanding and prediction of behavior, and (3) the application of this knowledge to the task of controlling behavior.

2.2 By integrating apparently unrelated facts into a coherent whole, theories permit psychologists to make the leap from the description of behavior to the understanding of behavior. Confidence in a theory increases when hypotheses derived from it are supported by research.

2.3 A scientific investigation follows a systematic pattern that includes five steps: (1) formulate a testable hypothesis, (2) select the research method and design the study, (3) collect the data, (4) analyze the data and draw conclusions, and (5) report the findings.

2.4 One major advantage of the scientific approach is its clarity in communication, which is promoted by its use of operational definitions. Another key advantage is its relative intolerance of error, which is promoted by scientists' constant testing of hypotheses and skeptical scrutiny of research findings.

web link 2.1

PubMed

Few commercial databases of journal articles or abstracts in the health sciences are available online for no charge. However, the National Library of Medicine has opened the millions of items in MEDLINE's database to anyone wanting to search within the scientific literature of medical journals, including some important psychology publications.

Looking for Causes: Experimental Research

Key Learning Goals

2.5 Describe the experimental method, independent and dependent variables, and experimental and control groups.

2.6 Explain how experiments can vary in format and design.

2.7 Describe the Featured Study on how expectations influence reactions to positive and negative outcomes.

2.8 Evaluate the major advantages and disadvantages of the experimental method.

Does misery love company? This question intrigued social psychologist Stanley Schachter. When people feel anxious, he wondered, do they want to be left alone, or do they prefer to have others around? Schachter's review of relevant theories suggested that in times of anxiety people would want others around to help them sort out their feelings. Thus, his hypothesis was that increases in anxiety would cause increases in the desire to be with others, which psychologists call the *need for affiliation*. To test this hypothesis, Schachter (1959) designed a clever experiment.

The *experiment* is a research method in which the investigator manipulates a variable under carefully controlled conditions and observes whether any changes occur in a second variable as a result. The experiment is a relatively powerful procedure that allows researchers to detect cause-and-effect relationships. Psychologists depend on this method more than any other.

Although its basic strategy is straightforward, in practice the experiment is a fairly complicated technique. A well-designed experiment must take into account a number of factors that could affect the clarity of the results. To see how an experiment is designed, let's use Schachter's study as an example.

Independent and Dependent Variables

SIM1,1b

The purpose of an experiment is to find out whether changes in one variable (let's call it *X*) cause changes in another variable (let's call it *Y*). To put it more

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web link 2.2

PsycINFO Direct

The definitive resource for information on the scientific literature in psychology is the PsycINFO database of abstracts maintained by the American Psychological Association (see the Personal Application for this chapter). You may be able to access this database for free through your college library. If not, you can purchase access to PsycINFO Direct via the Internet. However, it would be wise to carefully plan your research in advance, as the cost is not cheap ($9.95 for a 24-hour period).

concisely, we want to find out *how X affects Y*. In this formulation, we refer to *X* as the *independent variable* and to *Y* as the *dependent variable*.

An *independent variable* is a condition or event that an experimenter varies in order to see its impact on another variable. The independent variable is the variable that the experimenter controls or manipulates. It is hypothesized to have some effect on the dependent variable, and the experiment is conducted to verify this effect. **The *dependent variable* is the variable that is thought to be affected by manipulation of the independent variable.** In psychology studies, the dependent variable is usually a measurement of some aspect of the participants' behavior. The independent variable is called *independent* because it is *free* to be varied by the experimenter. The dependent variable is called *dependent* because it is thought to *depend* (at least in part) on manipulations of the independent variable.

In Schachter's experiment, *the independent variable was the subjects' anxiety level*. He manipulated anxiety level in a clever way. Participants assembled in his laboratory were told by a "Dr. Zilstein" that they would be participating in a study on the physiological effects of electric shock. They were further informed that during the experiment they would receive a series of electric shocks while their pulse and blood pressure were being monitored. Half of the subjects were warned that the shocks would be very painful. They made up the *high-anxiety* group. The other half of the participants (the *low-anxiety* group) were told that the shocks would be mild and painless. In reality, there was no plan to shock anyone at any time. These orientation procedures were simply intended to evoke different levels of anxiety. After the orientation, the experimenter indicated that there would be a delay while he prepared the shock apparatus for use. The participants were asked whether they would prefer to wait alone or in the company of others. *The participants' desire to affiliate with others was the dependent variable.*

concept check 2.1

Recognizing Independent and Dependent Variables

Check your understanding of the experimental method by identifying the independent variable (IV) and dependent variable (DV) in the following investigations. Note that one study has two IVs and another has two DVs. You'll find the answers in Appendix A in the back of the book.

1. A researcher is interested in how heart rate and blood pressure are affected by viewing a violent film sequence as opposed to a nonviolent film sequence.
   IV _____
   DV _____

2. An organizational psychologist develops a new training program to improve clerks' courtesy to customers in a large chain of retail stores. She conducts an experiment to see whether the training program leads to a reduction in the number of customer complaints.
   IV _____
   DV _____

3. A researcher wants to find out how stimulus complexity and stimulus contrast (light/dark variation) affect infants' attention to stimuli. He manipulates stimulus complexity and stimulus contrast and measures how long infants stare at various stimuli.
   IV _____
   DV _____

4. A social psychologist investigates the impact of group size on subjects' conformity in response to group pressure.
   IV _____
   DV _____

Experimental and Control Groups

SIM1, 1b

In an experiment the investigator typically assembles two groups of subjects who are treated differently with regard to the independent variable. These two groups are referred to as the experimental group and the control group. **The *experimental group* consists of the subjects who receive some special treatment in regard to the independent variable. The *control group* consists of similar subjects who do *not* receive the special treatment given to the experimental group.**

In the Schachter study, the participants in the high-anxiety condition constituted the experimental group. They received a special treatment designed to create an unusually high level of anxiety. The participants in the low-anxiety condition served as the control group. They were not exposed to the special anxiety-arousing procedure.

It is crucial that the experimental and control groups in a study be alike, except for the different treatment that they receive in regard to the independent variable. This stipulation brings us to the logic that underlies the experimental method. If the two groups are alike in all respects *except for the variation created by the manipulation of the independent variable,* any differences between the two groups on the dependent variable *must be due to the manipulation of the independent variable.* In this way researchers isolate the effect of the independent variable on the dependent variable. Schachter, for example, isolated the impact of anxiety on the need for affiliation. As predicted, he found that increased anxiety led to increased affiliation. As Figure 2.5 indicates, the percentage of participants in the high-anxiety group who wanted to wait with others was nearly twice that of the low-anxiety group.

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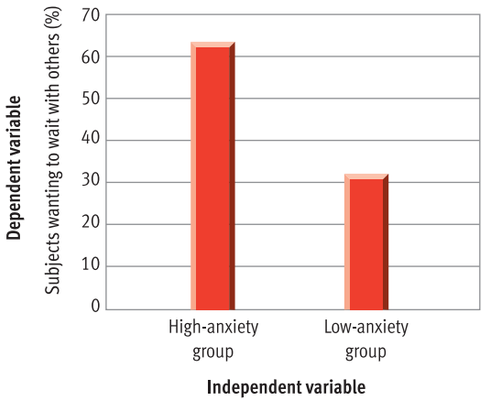

Figure 2.5

Results of Schachter's study of affiliation. The percentage of people wanting to wait with others was higher in the high-anxiety (experimental) group than in the low-anxiety (control) group, consistent with Schachter's (1959) hypothesis that anxiety would increase the desire for affiliation. The graphic portrayal of these results allows us to see at a glance the effects of the experimental manipulation on the dependent variable.

Extraneous Variables

SIM1,1b

As we have seen, the logic of the experimental method rests on the assumption that the experimental and control groups are alike except for their treatment in regard to the independent variable. Any other differences between the two groups can cloud the situation and make it impossible to draw conclusions about how the independent variable affects the dependent variable.

In practical terms, of course, it is impossible to ensure that two groups of participants are exactly alike in *every* respect. In reality, the experimental and control groups have to be alike only on dimensions relevant to the dependent variable. Thus, Schachter did not need to worry about whether his two groups were similar in hair color, height, or interest in ballet, as these variables were unlikely to influence the dependent variable of affiliation behavior.

Instead, experimenters concentrate on ensuring that the experimental and control groups are alike on a limited number of variables that could have a bearing on the results of the study. These variables are called extraneous, secondary, or nuisance variables. ***Extraneous variables*** **are any variables other than the independent variable that seem likely to influence the dependent variable in a specific study.**

In Schachter's study, one extraneous variable would have been the subjects' tendency to be sociable. Why? Because participants' sociability could affect their desire to be with others (the dependent variable). If the participants in one group had happened to be more sociable (on the average) than those in the other group, the variables of anxiety and sociability would have been confounded. **A *confounding of variables* occurs when two variables are linked together in a way that makes it difficult to sort out their specific effects.** When an extraneous variable is confounded with an independent variable, a researcher cannot tell which is having what effect on the dependent variable.

Unanticipated confoundings of variables have wrecked innumerable experiments. That is why so much care, planning, and forethought must go into designing an experiment. One of the key qualities that separates a talented experimenter from a mediocre one is the ability to foresee troublesome extraneous variables and control them to avoid confoundings.

Experimenters use a variety of safeguards to control for extraneous variables. For instance, subjects are usually assigned to the experimental and control groups randomly. ***Random assignment*** **of subjects occurs when all subjects have an equal chance of being assigned to any group or condition in the study.** When experimenters distribute subjects into groups through some random procedure, they can be reasonably confident that the groups will be similar in most ways. Figure 2.6 on the next page provides an overview of the elements in an experiment, using Schachter's study as an example.

Variations in Designing Experiments

SIM1,1b

We have discussed the experiment in only its simplest format, with just one independent variable and one dependent variable. Actually, many variations are possible in conducting experiments. Because you'll be learning about experiments with more complicated designs, these variations merit a brief mention.

First, it is sometimes advantageous to use only one group of subjects who serve as their own control group. The effects of the independent variable are evaluated by exposing this single group to two different conditions—an *experimental condition* and a *control condition*. For example, imagine that you wanted to study the effects of loud music on typing performance. You could have a group of participants work on a typing task while loud music was played (experimental condition) and in the absence of music (control condition). This approach would ensure that the participants in the experimental and control conditions would be alike on any extraneous variables involving their personal characteristics, such as motivation or typing skill. After all, the same people would be studied in both conditions.

web link 2.3

Psychological Research on the Net

This site, sponsored by the American Psychological Society, is a jumping-off point for people interested in participating in ongoing research projects that are collecting data over the Internet. Visitors will find a variety of opportunities for taking part in genuine research.

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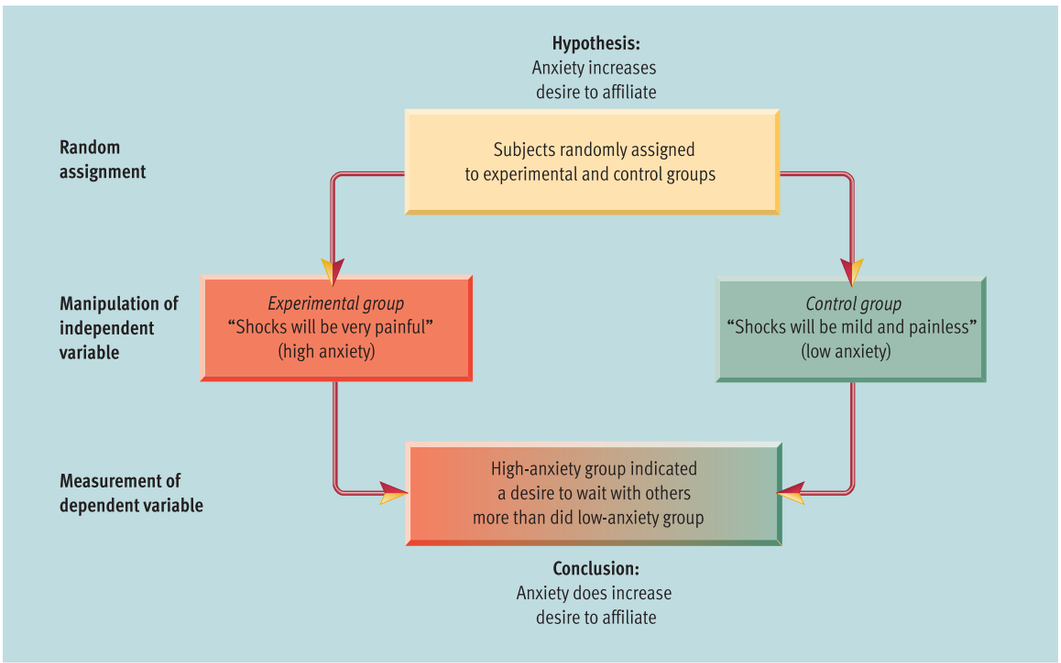

Figure 2.6
The basic elements of an experiment. As illustrated by the Schachter (1959) study, the logic of experimental design rests on treating the experimental and control groups exactly alike (to control for extraneous variables) except for the manipulation of the independent variable. In this way, the experimenter attempts to isolate the effects of the independent variable on the dependent variable.

When subjects serve as their own control group, the experiment is said to use a *within-subjects design* because comparisons are made within the same group of participants. In contrast, when two or more independent groups of subjects are exposed to a manipulation of an independent variable, the experiment is said to use a *between-subjects design* because comparisons are made between two different groups of participants. Although within-subjects designs are not used as frequently as between-subjects designs, they are advantageous for certain types of investigations and they play a major role in experimental research.

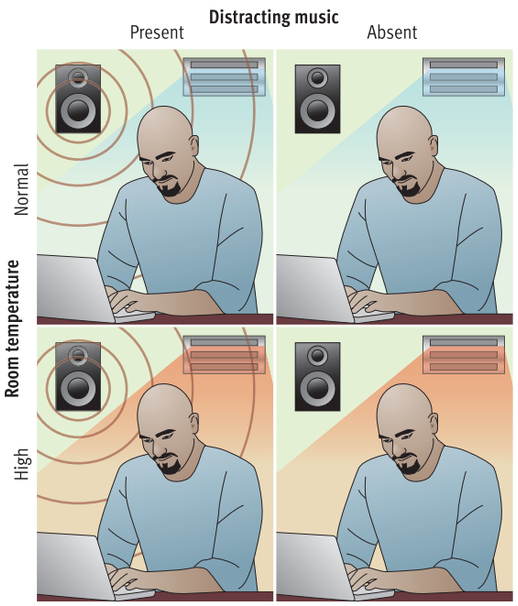

Figure 2.7
Manipulation of two independent variables in an experiment. As this example shows, when two independent variables are manipulated in a single experiment, the researcher has to compare four groups of subjects (or conditions) instead of the usual two. The main advantage of this procedure is that it allows an experimenter to see whether two variables interact.

Second, it is possible to manipulate more than one independent variable in a single experiment. Researchers often manipulate two or three independent variables to examine their joint effects on the dependent variable. For example, in another study of typing performance, you could vary both room temperature and the presence of distracting music (see **Figure 2.7**). The main advantage of this approach is that it permits the experimenter to see whether two variables interact. An *interaction* means that the effect of one variable depends on the effect of another. For instance, if we found that distracting music impaired typing performance only when room temperature was high, we would be detecting an interaction.

Third, it is also possible to use more than one dependent variable in a single study. Researchers frequently use a number of dependent variables to get a more complete picture of how experimental manipulations affect subjects' behavior. For example, in your studies of typing performance, you would probably measure two dependent variables: speed (words per minute) and accuracy (number of errors).

Now that you're familiar with the logic of the experiment, let's turn to our Featured Study for Chapter 2. You will find a Featured Study in each chapter from this point onward. These studies are provided to give you in-depth examples of how psychologists conduct empirical research. Each is described in

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a way that resembles a journal article, thereby acquainting you with the format of scientific reports (see the Personal Application at the end of the chapter for more information on this format). The Featured Study for this chapter gives you another example of an experiment in action.

The Emotional Fallout of Expected and Unexpected Outcomes

FEATURED STUDY

SOURCE: Shepperd, J. A., & McNulty, J. K. (2002). The affective consequences of expected and unexpected outcomes. *Psychological Science, 13,* 85–88.

Common sense suggests that people feel good when they experience positive outcomes and that they are disappointed when they experience setbacks, but Shepperd and McNulty theorize that people's reactions to events aren't that simple—that outcomes are judged relative to expectations. According to decision affect theory (Mellers et al., 1997), people's feelings about events are determined in part by comparing what actually happened with what might have been. Thus, two outcomes that are objectively the same can produce very different emotional reactions depending on the participant's expectations. Specifically, they hypothesized that bad outcomes feel worse when unexpected than when expected and that positive outcomes feel better when unexpected than when expected.

Their first test of this hypothesis consisted of a small survey in which students rated how happy they would feel in response to four scenarios: (1) they expected to earn an A in a course and they received an A, (2) they expected an A and got a C, (3) they expected a C and got an A, and (4) they expected a C and got a C. Subjects' ratings of how they would feel about each of these scenarios, which can be seen in **Figure 2.8**, supported the hypothesis that events are judged relative to expectations. After obtaining these encouraging findings, Shepperd and McNulty then put their hypothesis to an experimental test.

Method

Participants. Ninety introductory psychology students (25 males, 65 females) served as subjects. They earned credit toward a course requirement mandating participation in research. They participated in groups of 1 to 3 people.

Procedure. Subjects met an experimenter wearing a lab coat who appeared to be affiliated with the university hospital. They were told that the study was concerned with their attitudes about a new home medical test that was designed to detect a plausible-sounding but fictitious medical condition (an enzyme deficiency). They were given the (bogus) medical test, which required them to hold a strip under their tongue for 30 seconds. The strips were collected and taken away for analysis. In a few minutes the experimenter returned and gave each participant a sealed envelope containing his or her test results. Using a between-subjects design, participants' expectations were manipulated as follows. Half the subjects were told that the enzyme deficiency was uncommon among college students, so they expected good news, whereas the other half were told that the enzyme deficiency was quite prevalent among college students, so they expected bad news. After getting their test results, participants were asked to rate their emotions. After their ratings were turned in, they were thoroughly debriefed about the true nature of the study.

Results

The data are summarized in **Figure 2.9**, which shows the mean emotion ratings for each condition. As predicted, subjects who were informed that they tested positive for the enzyme deficiency felt worse when this news was unexpected than when it was expected. And those who were told that they did not have the enzyme deficiency felt better when this result was unexpected than when it was expected.

Discussion

The authors conclude that their results provide strong support for their hypothesis that people's expectations color their evaluation of events. As they put it, "People feel bad

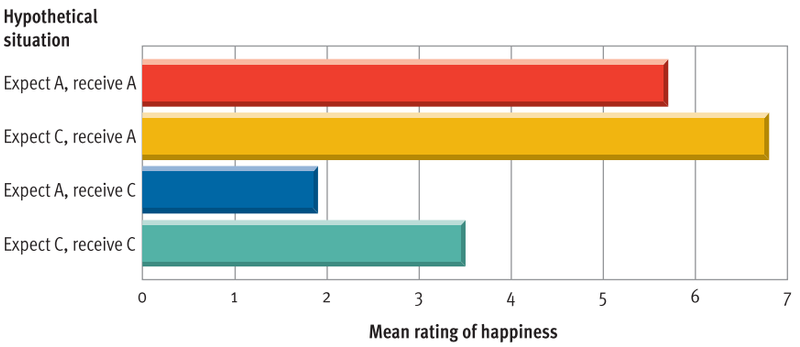

Figure 2.8

Effects of expectations on reactions to grades. Shepperd and McNulty (2002) asked subjects to rate how happy they would feel if they experienced each of the grading scenarios described on the left. As predicted, a positive outcome (receiving an A) resulted in greater happiness when it was unexpected, and a negative outcome (receiving a C) generated more disappointment when it was unexpected.

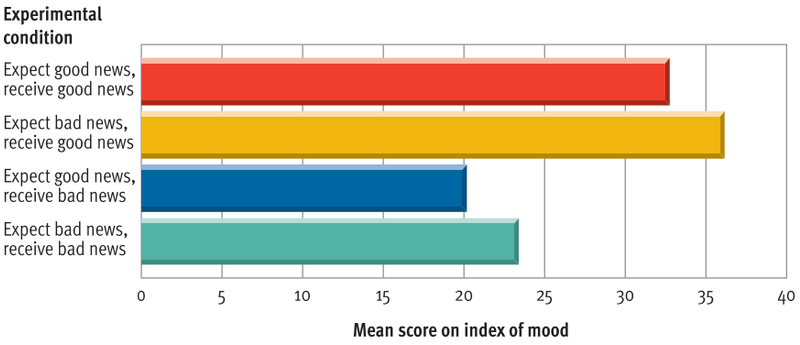

Figure 2.9

Effects of expectations on reactions to positive and negative outcomes. In their experiment, Shepperd and McNulty (2002) manipulated subjects' expectations about the likely result of an apparent medical test. After receiving either good or bad test results, participants filled out ratings of their emotions that were summed into the mood scores graphed here. As you can see, people felt better about good news when it was unexpected, and they felt better about bad news when it was expected.

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when their outcomes fall short of their expectations and feel elated when their outcomes exceed their expectations" (p. 87). They note that their findings are consistent with the folk wisdom contained in the advice "Expect the worst and you will never be disappointed."

Comment

This study was featured because it addresses an interesting question using a reasonably straightforward experimental design. It also provides a nice demonstration of one of this text's unifying themes—that people's experience of the world is highly subjective. It shows how two individuals can experience the same event—for example, getting a grade of C in a course—but react to it very differently. The study also highlights the enormous power of expectations, which is a phenomenon that we will see repeatedly as we proceed through this book.

Advantages and Disadvantages of Experimental Research

The experiment is a powerful research method. Its principal advantage is that it permits conclusions about cause-and-effect relationships between variables. Researchers are able to draw these conclusions about causation because the precise control available in the experiment allows them to isolate the relationship between the independent variable and the dependent variable while neutralizing the effects of extraneous variables. No other research method can duplicate this strength of the experiment. This advantage is why psychologists usually prefer to use the experimental method whenever possible.

For all its power, however, the experiment has limitations. One problem is that experiments are often artificial. Because experiments require great control over proceedings, researchers must often construct simple, contrived situations to test their hypotheses experimentally. For example, to investigate decision making in juries, psychologists have conducted many experiments in which subjects read a brief summary of a trial and then record their individual "verdicts" of innocence or guilt. This approach allows the experimenter to manipulate a variable, such as the race of the defendant, to see whether it affects the participants' verdicts. However, critics have pointed out that having a participant read a short case summary and make an individual decision cannot really compare to the complexities of real trials (Weiten & Diamond, 1979). In actual court cases, jurors may spend weeks listening to confusing testimony while making subtle judgments about the credibility of witnesses. They then retire for hours of debate to arrive at a group verdict, which is quite different from rendering an individual decision. Many researchers have failed to do justice to this complex process in their laboratory experiments. When experiments are highly artificial, doubts arise about the applicability of findings to everyday behavior outside the experimental laboratory.

Another disadvantage is that the experimental method can't be used to explore some research questions. Psychologists are frequently interested in the effects of factors that cannot be manipulated as independent variables because of ethical concerns or practical realities. For instance, you might be interested in whether a nutritionally poor diet during pregnancy increases the likelihood of birth defects. This clearly is a significant issue. However, you obviously cannot select 100 pregnant women and assign 50 of them to a condition in which they consume an inadequate diet. The potential risk to the health of the women and their unborn children would make this research strategy unethical.

In other cases, manipulations of variables are difficult or impossible. For example, you might want to know whether being brought up in an urban as opposed to a rural area affects people's values. An experiment would require you to randomly assign similar families to live in urban and rural areas, which obviously is impossible to do. To explore this question, you would have to use descriptive/correlational research methods, which we turn to next.

REVIEW of Key Learning Goals

2.5 Experimental research involves the manipulation of an independent variable to determine its effect on a dependent variable. This research is usually done by comparing experimental and control groups, which must be alike in regard to important extraneous variables. Any differences between the groups in the dependent variable ought to be due to manipulation of the independent variable, as long as there are no confounds.

2.6 Experimental designs may vary. For example, sometimes an experimental group serves as its own control group. And many experiments have more than one independent variable or more than one dependent variable.

2.7 In our first Featured Study, Shepperd and McNulty (2002) used the experimental method to demonstrate that emotional reactions to events depend on people's expectations. Their results showed that bad outcomes feel worse when unexpected and that good outcomes feel better when unexpected.

2.8 The experiment is a powerful research method that permits conclusions about cause-and-effect relationships between variables. However, the experimental method is often not usable for a specific problem, and many experiments tend to be artificial.

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Key Learning Goals

2.9 Explain the role of naturalistic observation, case studies, and surveys in psychological research.

2.10 Evaluate the major advantages and disadvantages of descriptive/correlational research.

Looking for Links: Descriptive/Correlational Research

As we just noted, in some situations psychologists cannot exert experimental control over the variables they want to study. In such situations, investigators must rely on *descriptive/correlational research methods*. These methods include naturalistic observation, case studies, and surveys. What distinguishes these methods is that the researcher cannot manipulate the variables under study. This lack of control means that these methods cannot be used to demonstrate cause-and-effect relationships between variables. *Descriptive/correlational methods permit investigators to only describe patterns of behavior and discover links or associations between variables*. That is not to suggest that associations are unimportant. You'll see in this section that information on associations between variables can be extremely valuable in our efforts to understand behavior.

Naturalistic Observation

Does the pace of everyday life vary substantially from one culture to the next? Do people operate at a different speed in say, Germany, as opposed to Canada or Brazil? Are factors such as economic vitality and climate related to differences in the pace of life? These are the kinds of questions that intrigued Robert V. Levine and Ara Norenzayan (1999), who compared the pace of life in more than two dozen countries around the world. Perhaps they could have devised an experiment to examine this question, but they wanted to focus on the pace of life in the real world rather than in the laboratory.

To study the pace of life, Levine and Norenzayan (1999) had to come up with concrete ways to measure it—their operational definition of the concept. The measures they chose depended on *naturalistic observation*. **In *naturalistic observation* a researcher engages in careful observation of behavior without intervening directly with the subjects.** In this instance, the researchers observed (1) the average walking speed in downtown locations, (2) the accuracy of public clocks, and (3) the speed with which postal clerks completed a simple request. Their collection of data on walking speed illustrates the careful planning required to execute naturalistic observation effectively. In the main downtown area of each city, they had to find two flat, unobstructed, uncrowded 60-foot walkways where they could unobtrusively time pedestrians during normal business hours. Only adult pedestrians walking alone and not window shopping were timed. In most cities, the observations continued until 35 men and 35 women had been timed.

Levine and Norenzayan conducted their naturalistic observations in 31 countries, typically using the largest city in each country as the locale for their research. Their findings, based on all three measures, are summarized in Table 2.2, which ranks the pace of life in the countries studied. Their data suggest that the pace of life is fastest in the countries of Western Europe and in Japan. Using archival data, they also conducted correlational analyses to see whether variations in the pace of life were associated with factors such as climate, economic

Table 2.2 Levine and Norenzayan's (1999) Ranking of the Pace of Life in 31 Cultures

Rank	Country	Rank	Country	Rank	Country
1	Switzerland	11	France	21	Greece
2	Ireland	12	Poland	22	Kenya
3	Germany	13	Costa Rica	23	China
4	Japan	14	Taiwan	24	Bulgaria
5	Italy	15	Singapore	25	Romania
6	England	16	United States	26	Jordan
7	Sweden	17	Canada	27	Syria
8	Austria	18	S. Korea	28	El Salvador
9	Netherlands	19	Hungary	29	Brazil
10	Hong Kong	20	Czech Republic	30	Indonesia
				31	Mexico

Source: Adapted from Levine, R. V., & Norenzayan, A. (1999). The pace of life in 31 countries. *Journal of Cross-Cultural Psychology, 30* (2), 178–205. Copyright © 1999 by Sage Publications. Reprinted by permission.

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The method of naturalistic observation can be particularly useful in studying animals in their natural habitats. For example, Jane Goodall conducted ground-breaking research on the social lives of chimpanzees through years of painstaking naturalistic observation.

vitality, or population size. Among other things, they found that the pace of life was faster in colder climates and in countries that were more economically productive.

This type of research is called *naturalistic* because behavior is allowed to unfold naturally (without interference) in its natural environment—that is, the setting in which it would normally occur. The major strength of naturalistic observation is that it allows researchers to study behavior under conditions that are less artificial than in experiments. Another plus is that engaging in naturalistic observation can represent a good starting point when little is known about the behavior under study. And, unlike case studies and surveys, naturalistic observation can be used to study animal behavior. Many landmark studies of animal behavior, such as Jane Goodall's (1986, 1990) work on the social and family life of chimpanzees, have depended on naturalistic observation. A major problem with this method is that researchers often have trouble making their observations unobtrusively so they don't affect their participants' behavior. ***Reactivity* occurs when a subject's behavior is altered by the presence of an observer.** Both animals and humans may exhibit reactivity if observational efforts are too obvious. Another disadvantage is that it often is difficult to translate naturalistic observations into numerical data that permit precise statistical analyses.

Case Studies

What portion of people who commit suicide suffer from psychological disorders? Which disorders are most common among victims of suicide? In health care visits during the final month of their lives, do people who commit suicide communicate their intent to do so? A research team in Finland wanted to investigate the psychological characteristics of people who take their own lives (Henriksson et al., 1993; Isometsa et al., 1995). Other researchers had explored these questions, but the Finnish team planned a comprehensive, national study of unprecedented scope. Their initial sample consisted of all the known suicides in Finland for an entire year.

The research team decided that their question called for a case study approach. **A *case study* is an in-depth investigation of an individual subject.** When this method is applied to victims of suicide the case studies are called *psychological autopsies*. A variety of data collection techniques can be used in case studies. In normal circumstances, when the participants are not deceased, typical techniques include interviewing the subjects, interviewing people who are close to the subjects, direct observation of the participants, examination of records, and psychological testing. In this study, the investigators conducted thorough interviews with the families of the suicide victims and with the health care professionals who had treated them. The researchers also examined the suicide victims' medical, psychiatric, and social agency records, as well as relevant police investigations and forensic reports. Comprehensive case reports were then assembled for each person who committed suicide.

These case studies revealed that in 93% of the suicides the victim suffered from a significant psychological disorder (Henriksson et al., 1993). The most common diagnoses, by a large margin, were depression and alcohol dependence. In 571 cases, victims had a health care appointment during the last four weeks of their lives, but only 22% of these people discussed the possibility of suicide during their final visit (Isometsa et al., 1995). Even more surprising, the sample included 100 people who saw a health professional on the same day they killed themselves, yet only 21% of these individuals raised the issue of suicide. The investigators concluded that mental illness is a contributing factor in virtually all completed suicides and that the vast majority of suicidal people do not spontaneously reveal their intentions to health care professionals.

Clinical psychologists, who diagnose and treat psychological problems, routinely do case studies of their clients (see **Figure 2.10**). When clinicians assemble a case study for diagnostic purposes, they generally are *not* conducting empirical research. Case study *research* typically involves investigators

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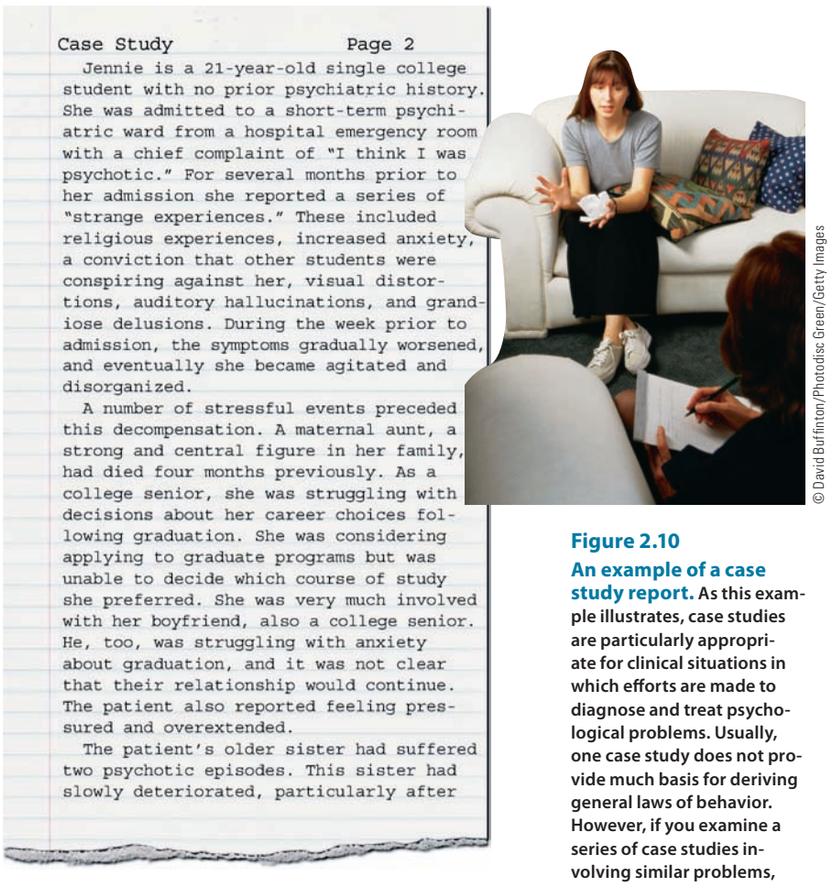
analyzing a collection or consecutive series of case studies to look for patterns that permit general conclusions. That said, clinicians sometimes publish individual case studies that seem to yield useful insights about a particular disorder or approach to treatment (Edwards, 2007).

Case studies are particularly well suited for investigating certain phenomena, especially the roots of psychological disorders and the efficacy of selected therapeutic practices (Fishman, 2007). They can also provide compelling, real-life illustrations that bolster a hypothesis or theory. However, the main problem with case studies is that they are highly subjective. Information from several sources must be knit together to capture one's impressions of the subject. In this process, clinicians and researchers often focus selectively on information that fits with their expectations, which usually reflect their theoretical slant. Thus, it is relatively easy for investigators to see what they expect to see in case study research. Another worrisome issue is that the clinical samples typically used in case study research are often unrepresentative of the general population.


Case Study Page 2

Jennie is a 21-year-old single college student with no prior psychiatric history. She was admitted to a short-term psychiatric ward from a hospital emergency room with a chief complaint of "I think I was psychotic." For several months prior to her admission she reported a series of "strange experiences." These included religious experiences, increased anxiety, a conviction that other students were conspiring against her, visual distortions, auditory hallucinations, and grandiose delusions. During the week prior to admission, the symptoms gradually worsened, and eventually she became agitated and disorganized.

A number of stressful events preceded this decompensation. A maternal aunt, a strong and central figure in her family, had died four months previously. As a college senior, she was struggling with decisions about her career choices following graduation. She was considering applying to graduate programs but was unable to decide which course of study she preferred. She was very much involved with her boyfriend, also a college senior. He, too, was struggling with anxiety about graduation, and it was not clear that their relationship would continue. The patient also reported feeling pressured and overextended.

The patient's older sister had suffered two psychotic episodes. This sister had slowly deteriorated, particularly after

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Figure 2.10
An example of a case study report. As this example illustrates, case studies are particularly appropriate for clinical situations in which efforts are made to diagnose and treat psychological problems. Usually, one case study does not provide much basis for deriving general laws of behavior. However, if you examine a series of case studies involving similar problems, you can look for threads of consistency that may yield general conclusions.

SOURCE: Greenfield, D. (1985). *The psychotic patient: Medication and psychotherapy.* New York: The Free Press. Copyright © 1985 by David Greenfeld. Reprinted by permission of the author.

Surveys

Are taller people more successful in life? That would hardly seem fair, but folk wisdom suggests that height is associated with success. Some empirical studies of this issue have been conducted over the years, but many of them are extremely old and hobbled by a variety of methodological weaknesses. Hence, Timothy Judge and Daniel Cable (2004) set out to conduct a thorough investigation of the relationship between height and income. Their study depended on survey data. **In a *survey* researchers use questionnaires or interviews to gather information about specific aspects of participants' background, attitudes, beliefs, or behavior.** In this case, Judge and Cable examined already-existing data that had been collected in four large-scale surveys that were concerned with other issues. Information on height and income was available for over 8000 participants from these studies.

What did the survey data reveal? In all four studies a modest association was found between height and income, with taller people earning more money. The association was not particularly strong, but it was not negligible. For example, based on their data, Judge and Cable estimated that someone 6 feet tall would earn $166,000 more during a 30-year career than someone 5 feet 5 inches tall. The relationship between greater height and greater income held for both men and women. The strength of the association varied somewhat across occupational areas. The height-income link was strongest for people in sales or management. The authors conclude that "our analyses revealed that height clearly matters in the context of workplace success" (p. 437). They discuss a variety of possible explanations for the association between height and earnings. Among other things, they note that taller people may develop higher self-esteem, which could foster better performance. Another possibility is that people just assume that taller individuals are more capable and competent and hence are more likely to buy products from them, hire them for good jobs, and promote them into even better positions. The exact mechanisms underlying the correlation between height and income are yet to be determined.

Surveys are often used to obtain information on aspects of behavior that are difficult to observe directly. Surveys also make it relatively easy to collect data on attitudes and opinions from large samples of participants. However, potential participants' tendency to cooperate with surveys appears to have declined noticeably in recent decades (Tourangeau,

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concept check 2.2

Matching Research Methods to Questions

Check your understanding of the uses and strengths of various research methods by figuring out which method would be optimal for investigating the following questions about behavioral processes. Choose from the following methods: (a) experiment, (b) naturalistic observation, (c) case study, and (d) survey. Indicate your choice (by letter) next to each question. You'll find the answers in Appendix A in the back of the book.

_____ **1.** Are people's attitudes about nuclear disarmament related to their social class or education?

_____ **2.** Do people who suffer from anxiety disorders share similar early childhood experiences?

_____ **3.** Do troops of baboons display territoriality—that is, do they mark off an area as their own and defend it from intrusion by other baboons?

_____ **4.** Can the presence of food-related cues (delicious-looking desserts in advertisements, for example) cause an increase in the amount of food that people eat?

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2004). The growing resentment of intrusive telemarketing and heightened concerns about privacy and identity theft seem to be the culprits underlying the reduced response rates for research surveys. This problem may be partially offset by new technology, as survey studies are increasingly being conducted over the Internet (Skitka & Sargis, 2006). The major weakness of surveys is that they depend on *self-report data*. As we'll discuss later, intentional deception, wishful thinking, memory lapses, and poorly worded questions can distort participants' verbal reports about their behavior (Krosnick, 1999).

Advantages and Disadvantages of Descriptive/Correlational Research

Descriptive/correlational research methods have advantages and disadvantages, which are compared with the strengths and weaknesses of experimental research in an Illustrated Overview of research methods that appears on pages 62–63. As a whole, the foremost advantage of these methods is that they give researchers a way to explore questions that could not be examined with experimental procedures. For example, after-the-fact analyses would be the only ethical way to investigate the possible link between poor maternal nutrition and birth defects in humans. In a similar vein, if researchers hope to learn how urban and rural upbringing relate to people's values, they have to depend on descriptive methods, since they can't control where subjects grow up. Thus, *descriptive/correlational research broadens the scope of phenomena that psychologists are able to study.*

Unfortunately, descriptive methods have one significant disadvantage: Investigators cannot control events to isolate cause and effect. *Consequently, correlational research cannot demonstrate conclusively that two variables are causally related.* As an example, consider the cross-cultural investigation of the pace of life that we discussed earlier. Although Levine and Norenzayan (1999) found an association between colder climates and a faster pace of life, their data do not permit us to conclude that a cold climate *causes* a culture to move at a faster pace. Too many factors were left uncontrolled in the study. For example, we do not know how similar the cold and warm cities were. Climate could co-vary with some other factors, such as modernization or economic vitality, that might have led to the observed differences in the pace of life.

REVIEW of Key Learning Goals

2.9 Naturalistic observation involves careful, prolonged observation of behavior in its natural setting without any intervention. Clinical research depends heavily on case studies, which involve in-depth investigations of individuals. In a survey, researchers interview participants or administer questionnaires to gather information on specific aspects of attitudes or behavior. Each approach has its unique strengths and weaknesses.

2.10 Descriptive/correlational research methods allow psychologists to explore issues that might not be open to experimental investigation because the variables of interest cannot be manipulated. However, these research methods cannot demonstrate cause-effect relationships.

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Looking for Conclusions: Statistics and Research

Key Learning Goals

2.11 Describe three measures of central tendency and one measure of variability.

2.12 Distinguish between positive and negative correlations.

2.13 Discuss correlation in relation to prediction and causation.

2.14 Clarify the meaning of statistical significance.

Whether researchers use experimental or correlational methods, they need some way to make sense of their data. ***Statistics* is the use of mathematics to organize, summarize, and interpret numerical data.** Statistical analyses permit researchers to draw conclusions based on their observations. Many students find statistics intimidating, but statistics are an integral part of modern life. Although you may not realize it, you are bombarded with statistics nearly every day. When you read about economists' projections for inflation, when you check a baseball player's batting average, when you see the popularity ratings of television shows, you are dealing with statistics. In this section, we will examine a few basic statistical concepts that will help you understand the research discussed throughout this book. For the most part, we won't concern ourselves with the details of statistical *computations*. These details and some additional statistical concepts are discussed in Appendix B at the back of the book. At this juncture, we will discuss only the purpose, logic, and value of the two basic types of statistics: descriptive statistics and inferential statistics.

Descriptive Statistics

PSYK TREK 1c, 1d

***Descriptive statistics* are used to organize and summarize data.** They provide an overview of numerical data. Key descriptive statistics include measures of central tendency, measures of variability, and the coefficient of correlation. Let's take a brief look at each of these.

Central Tendency

PSYK TREK 1c

In summarizing numerical data, researchers often want to know what constitutes a typical or average score. To answer this question, they use three measures of central tendency: the median, the mean, and the mode. **The *median* is the score that falls exactly in the center of a distribution of scores.** Half of the scores fall above the median and half fall below it. **The *mean* is the arithmetic average of the scores in a distribution.** It is obtained by adding up all the scores and dividing by the total number of scores. Finally, **the *mode* is the most frequent score in a distribution.**

In general, the mean is the most useful measure of central tendency because additional statistical manipulations can be performed on it that are not possible with the median or mode. However, the mean is sensitive to extreme scores in a distribution, which can sometimes make the mean misleading. To illustrate, imagine that you're interviewing for a sales position at a company. Unbeknownst to you, the company's five salespeople earned the following incomes in the previous year: $20,000, $20,000, $25,000, $35,000, and $200,000. You ask how much the typical salesperson earns in a year. The sales director proudly announces that her five salespeople earned a *mean* income of $60,000 last year (the calculations are shown in Figure 2.11). However, before you order that new sports car, you had better inquire about the *median* and *modal* income for the sales staff. In this case, one extreme score ($200,000) has inflated the mean, making it unrepresentative of the sales staff's earnings. In this instance, the median ($25,000) and the mode ($20,000) both provide better estimates of what you are likely to earn.

Variability

PSYK TREK 1c

In describing a set of data, it is often useful to have some estimate of the variability among the scores. ***Variability* refers to how much the scores in a data set vary from each other and from the mean. The *standard deviation* is an index of the amount of variability in a set of data.** When variability is great, the standard deviation will be relatively large. When variability is low, the standard deviation will be smaller. This relationship is apparent if you examine the two sets of data in Figure 2.12 on the next page. The mean is the same for both sets of scores, but variability clearly is greater in set B than in set A. This greater variability yields a higher stan-

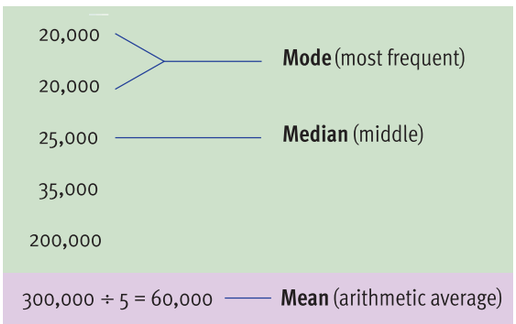

Figure 2.11
Measures of central tendency. The three measures of central tendency usually converge, but that is not always the case, as these data illustrate. Which measure is most useful depends on the nature of the data. Generally, the mean is the best index of central tendency, but in this instance the median is more informative.

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Figure 2.12
Variability and the standard deviation. Although these two sets of data produce the same mean, or average, an observer on Wild Street would see much more variability in the speeds of individual cars than an observer on Perfection Boulevard would. As you can see, the standard deviation for set B is higher than that for set A because of the greater variability in set B.

Speed (miles per hour)

Set A Perfection Boulevard		Set B Wild Street
35		21
34		37
33		50
37		28
38		42
40		37
36		39
33		25
34		23
30		48
35	Mean	35
2.87	Standard deviation	10.39

dard deviation for set B than for set A. Estimates of variability play a crucial role when researchers use statistics to decide whether the results of their studies support their hypotheses.

Correlation 1d

A *correlation* exists when two variables are related to each other. Investigators often want to quantify the strength of an association between two variables, such as between class attendance and course grades, or between cigarette smoking and physical disease. In this effort, they depend extensively on a useful descriptive statistic: the correlation coefficient. **The *correlation coefficient* is a numerical index of the degree of relationship between two variables.** A correlation coefficient indicates (1) the direction (positive or negative) of the relationship and (2) how strongly the two variables are related.

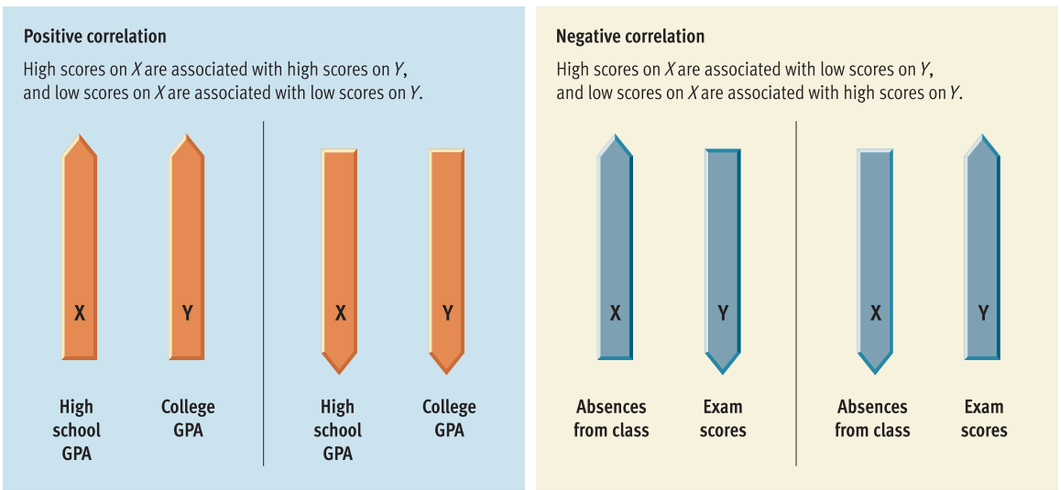
Positive Versus Negative Correlation. A *positive correlation* indicates that two variables co-vary in the *same* direction. This means that high scores on variable *X* are associated with high scores on variable *Y* and that low scores on variable *X* are associated with low scores on variable *Y*. For example, a positive correlation exists between high school grade point average (GPA) and subsequent college GPA. That is, people who do well in high school tend to do well in college, and those who perform poorly in high school tend to perform poorly in college (see Figure 2.13).

In contrast, a *negative* correlation indicates that two variables co-vary in the *opposite* direction. This means that people who score high on variable *X* tend to score low on variable *Y,* whereas those who score low on *X* tend to score high on *Y*. For example, in most college courses a negative correlation exists between how frequently students are absent and how well they perform on exams. Students who have a high number of absences tend to get low exam scores, while students who have a low number of absences tend to earn higher exam scores (see Figure 2.13).

If a correlation is negative, a minus sign (–) is always placed in front of the coefficient. If a correlation is positive, a plus sign (+) may be placed in front of the coefficient, or the coefficient may be shown with no sign. Thus, if there's no sign, the correlation is positive.

Strength of the Correlation. Whereas the positive or negative sign indicates the direction of an association, the *size of the coefficient* indicates the *strength* of an association between two variables. The coefficient can vary between 0 and +1.00 (if

Figure 2.13
Positive and negative correlation. Notice that the terms *positive* and *negative* refer to the direction of the relationship between two variables, not to its strength. Variables are positively correlated if they tend to increase and decrease together; they are negatively correlated if one tends to increase when the other decreases.



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positive) or between 0 and –1.00 (if negative). A coefficient near 0 indicates no relationship between the variables; that is, high or low scores on variable *X* show no consistent relationship to high or low scores on variable *Y*. A coefficient of +1.00 or –1.00 indicates a perfect, one-to-one correspondence between the two variables. Most correlations fall between these extremes.

The closer the correlation is to either –1.00 or +1.00, the stronger the relationship (see **Figure 2.14**). Thus, a correlation of .90 represents a stronger tendency for variables to be associated than a correlation of .40 does. Likewise, a correlation of –.75 represents a stronger relationship than a correlation of –.45. Keep in mind that the *strength* of a correlation depends only on the *size* of the coefficient. The positive or negative sign simply indicates the *direction* of the relationship. Therefore, a correlation of –.60 reflects a stronger relationship than a correlation of +.30.

To give you some concrete examples of correlation coefficients of different strengths, let's revisit some of the studies we discussed in the previous section. In our earlier example of naturalistic observation, Levine and Norenzayan (1999) found a robust correlation of +.74 between a measure of economic vitality (gross domestic product per capita) and the overall pace of life in various cultures, but they found a negligible correlation (–.07) between population size and the pace of life. In our earlier example of survey research, Judge and Cable (2004) found an average correlation of .29 between height and income. Thus, the computation of correlation coefficients permits researchers to precisely quantify the strength of the associations between variables.

Correlation and Prediction. You may recall that one of the key goals of scientific research is accurate *prediction*. A close link exists between the magnitude of a correlation and the power it gives scientists to make predictions. *As a correlation increases in strength (gets closer to either –1.00 or +1.00), the ability to predict one variable based on knowledge of the other variable increases.*

To illustrate, consider how college admissions tests (such as the SAT or ACT) are used to predict college performance. When students' admissions test scores and first-year college GPA are correlated, researchers generally find moderate positive correlations in the .40s and .50s (Gregory, 1996). Because of this relationship, college admissions committees can predict with modest accuracy how well prospective students will do in college. Admittedly, the predictive power of these admissions tests is *far* from perfect. But it's substantial enough to justify the use of the tests as one factor in making admissions decisions. However, if this correlation were much higher, say .90, admissions tests could predict with superb accuracy how students would perform. In contrast, if this correlation were much lower, say .20, the tests' prediction of college performance would be so poor that it would be unreasonable to consider the test scores in admissions decisions.

Correlation and Causation. Although a high correlation allows us to predict one variable from another, it does not tell us whether a cause-effect relationship exists between the two variables. The problem is that variables can be highly correlated even though they are not causally related. For example, there is a substantial positive correlation between the size of young children's feet and the size of their vocabulary. That is, larger feet are associated with a larger vocabulary. Obviously, increases in foot size do not *cause* increases in vocabulary size. Nor do increases in vocabulary size cause increases in foot size. Instead, both are caused by a third variable: an increase in the children's age.

When we find that variables *X* and *Y* are correlated, we can safely conclude only that *X* and *Y* are related. We do not know *how* *X* and *Y* are related. We do not know whether *X* causes *Y* or *Y* causes *X* or whether both are caused by a third variable. For example, survey studies have found a positive correla-

web link 2.4

HyperStat Online

For psychology researchers who find they've temporarily misplaced their statistics textbook, here's one written in hypertext by Professor David M. Lane of Rice University, and it's always available free online. He also includes links to excellent resources involving statistics, the analysis of experimental data, and even some statistical humor.

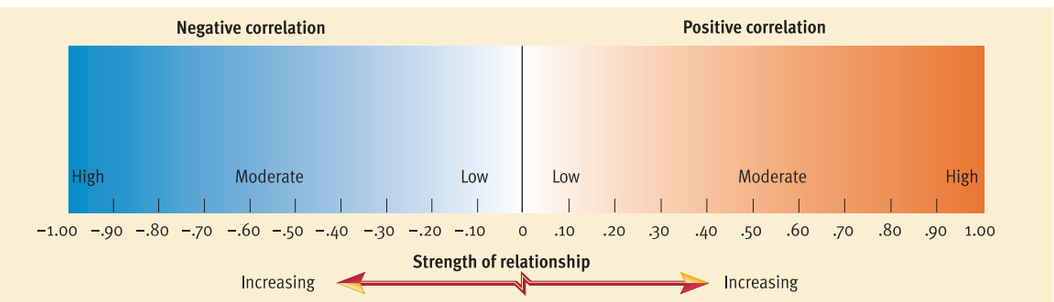

Figure 2.14
Interpreting correlation coefficients. **The magnitude of a correlation coefficient indicates the strength of the relationship between two variables. The sign (plus or minus) indicates whether the correlation is positive or negative. The closer the coefficient comes to +1.00 or –1.00, the stronger the relationship between the variables.**

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concept check 2.3

Understanding Correlation

Check your understanding of correlation by interpreting the meaning of the correlation in item 1 and by guessing the direction (positive or negative) of the correlations in item 2. You'll find the answers in Appendix A.

1. Researchers have found a substantial positive correlation between youngsters' self-esteem and their academic achievement (measured by grades in school). Check any acceptable conclusions based on this correlation.
   - _____ **a.** Low grades cause low self-esteem.
   - _____ **b.** There is an association between self-esteem and academic achievement.
   - _____ **c.** High self-esteem causes high academic achievement.
   - _____ **d.** High ability causes both high self-esteem and high academic achievement.
   - _____ **e.** Youngsters who score low in self-esteem tend to get low grades, and those who score high in self-esteem tend to get high grades.
2. Indicate whether you would expect the following correlations to be positive or negative.
   - _____ **a.** The correlation between age and visual acuity (among adults).
   - _____ **b.** The correlation between years of education and income.
   - _____ **c.** The correlation between shyness and the number of friends one has.

tion between smoking and the risk of experiencing a major depressive disorder (Johnson & Breslau, 2006; Kinnunen et al., 2006). Although it's clear that an association exists between smoking and depression, it's hard to tell what's causing what. The investigators acknowledge that they don't know whether smoking makes people more vulnerable to depression or whether depression increases the tendency to smoke. Moreover, they note that they can't rule out the possibility that both are caused by a third variable (*Z*). Perhaps anxiety and neuroticism increase the likelihood of both taking up smoking and becoming depressed. The plausible causal relationships in this case are diagrammed in Figure 2.15, which illustrates the "third variable problem" in interpreting correlations. This is a common problem in research, and you'll see this type of diagram again when we discuss other correlations. Thus, it is important to remember that *correlation is not equivalent to causation.*

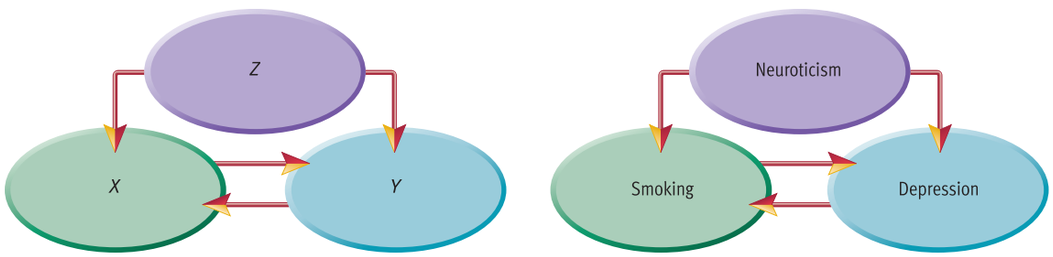

Figure 2.15
Three possible causal relations between correlated variables. If variables *X* and *Y* are correlated, does *X* cause *Y*, does *Y* cause *X*, or does some hidden third variable, *Z*, account for the changes in both *X* and *Y*? As the relationship between smoking and depression illustrates, a correlation alone does not provide the answer. We will encounter this problem of interpreting the meaning of correlations frequently in our discussions of behavioral research.

Inferential Statistics

After researchers have summarized their data with descriptive statistics, they still need to decide whether their data support their hypotheses. ***Inferential statistics* are used to interpret data and draw conclusions.** Working with the laws of probability, researchers use inferential statistics to evaluate the possibility that their results might be due to the fluctuations of chance.

To illustrate this process, envision a hypothetical experiment. A computerized tutoring program (the independent variable) is designed to increase sixth-graders' reading achievement (the dependent variable). Our hypothesis is that program participants (the experimental group) will score higher than nonparticipants (the control group) on a standardized reading test given near the end of the school year. Let's assume that we compare 60 subjects in each group. We obtain the following results, reported in terms of participants' grade-level scores for reading:

Control group		*Experimental group*
6.3	Mean	6.8
1.4	Standard deviation	2.4

We hypothesized that the training program would produce higher reading scores in the experimental group than in the control group. Sure enough, that is indeed the case. However, we have to ask ourselves a critical question: Is this observed difference between the two groups large enough to support our hypothesis? That is, do the higher scores in the experimental group reflect the effect of the training program? Or could a difference of this size have occurred by chance? If our results could easily have occurred by chance, they don't provide meaningful support for our hypothesis.

When statistical calculations indicate that research results are not likely to be due to chance, the results are said to be *statistically significant.* You will probably hear your psychology professor use this phrase quite frequently. In discussing research, it is routine to note that "statistically significant differences were found." In statistics, the word *significant* has a precise and special meaning. ***Statistical***

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***significance* is said to exist when the probability that the observed findings are due to chance is very low.** "Very low" is usually defined as less than 5 chances in 100, which is referred to as the *.05 level of significance*.

Notice that in this special usage, *significant* does not mean "important," or even "interesting." Statistically significant findings may or may not be theoretically significant or practically significant. They simply are research results that are unlikely to be due to chance.

You don't need to be concerned here with the details of how statistical significance is calculated. However, it is worth noting that a key consideration is the amount of variability in the data. That is why the standard deviation, which measures variability, is such an important statistic. When the necessary computations are made for our hypothetical experiment, the difference between the two groups does *not* turn out to be statistically significant. Thus, our results would not be adequate to demonstrate that our tutoring program leads to improved reading achievement. Psychologists have to do this kind of statistical analysis as part of virtually every study. Thus, inferential statistics are an integral element in the research enterprise.

REVIEW of Key Learning Goals

2.11 Psychologists use descriptive statistics to organize and summarize their numerical data. The mean, median, and mode are widely used measures of central tendency. The mean tends to be the most useful of these indexes, but it can be distorted by extreme scores. Variability is usually measured with the standard deviation, which increases as the variability in a data set grows.

2.12 Correlations may be either positive (when two variables co-vary in the same direction) or negative (when two variables co-vary in the opposite direction). The closer a correlation is to either +1.00 or –1.00, the stronger the association is.

2.13 As a correlation increases in strength, the ability to predict one variable based on knowledge of the other variable increases. However, a correlation is no assurance of causation. When variables are correlated, we do not know whether *X* causes *Y*, or *Y* causes *X*, or a third variable causes both.

2.14 Hypothesis testing involves deciding whether observed findings support the researcher's hypothesis. Findings are statistically significant only when they are extremely unlikely to be due to chance.

Looking for Flaws: Evaluating Research

Key Learning Goals

2.15 Articulate the importance of replication in research.

2.16 Recognize sampling bias and placebo effects in research.

2.17 Recognize problems with self-report data and experimenter bias in research.

Scientific research is a more reliable source of information than casual observation or popular belief. However, it would be wrong to conclude that all published research is free of errors. As we just saw, when researchers report statistically significant differences at the .05 level, there are 5 chances in 100 that the results really are a misleading by-product of chance fluctuation. This probability is pretty low, but it's not zero. Moreover, scientists' effort to minimize the probability of obtaining significant differences when none really exist increases the likelihood of the opposite mistake—failing to find significant differences when the groups really are different. Thus, even when research is conducted in a sound fashion, there's still a small chance of erroneous conclusions. Above and beyond this problem, we need to recognize that scientists are fallible human beings who do not conduct flawless research. Their personal biases in designing and interpreting studies can also distort research results (MacCoun, 1998).

For these reasons, researchers are reluctant to settle scientific questions on the basis of just one empirical study. Instead, important questions usually generate a flurry of studies to see whether key findings will stand the test of replication. ***Replication* is the repetition of a study to see whether the earlier results are duplicated.** The replication process helps science identify and purge erroneous findings. Of course, the replication process sometimes leads to contradictory results. You'll see some examples in later chapters. Inconsistent findings on a research question can be frustrating and confusing for students. However, some inconsistency in results is to be expected, given science's commitment to replication.

As you will see in upcoming chapters, scientific advances often emerge out of efforts to double-check perplexing findings or to explain contradictory research results. Thus, like all sources of information, scientific studies need to be examined with a critical eye. This section describes a number of common methodological problems that often spoil studies. Being aware of these pitfalls will make you more skilled in evaluating research.

Sampling Bias

A *sample* is the collection of subjects selected for observation in an empirical study. In contrast, **the *population* is the much larger collection of ani-**

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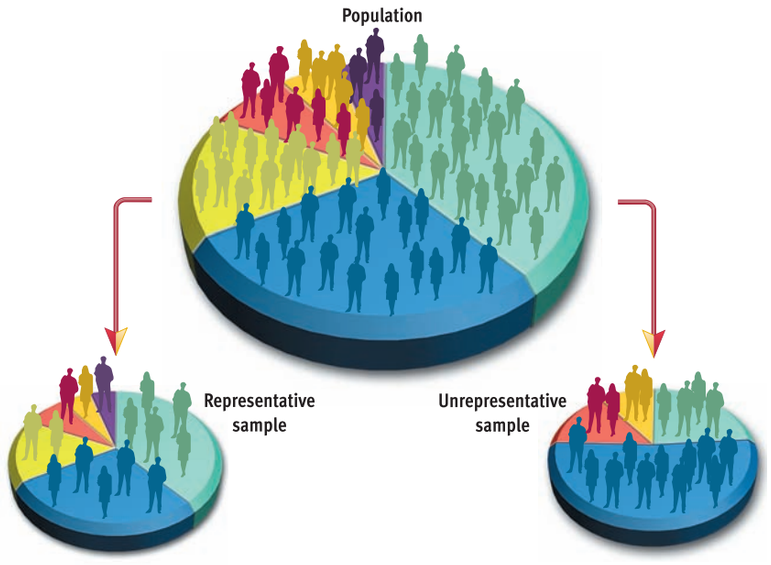

Figure 2.16
The relationship between the population and the sample. The process of drawing inferences about a population based on a sample works only if the sample is reasonably representative of the population. A sample is representative if its demographic makeup is similar to that of the population, as shown on the left. If some groups in the population are overrepresented or underrepresented in the sample, as shown on the right, inferences about the population may be skewed or inaccurate.

mals or people (from which the sample is drawn) that researchers want to generalize about (see Figure 2.16). For example, when political pollsters attempt to predict elections, all the voters in a jurisdiction represent the population, and the voters who are actually surveyed constitute the sample. If a researcher was interested in the ability of 6-year-old children to form concepts, those 6-year-olds actually studied would be the sample, and all similar 6-year-old children (perhaps those in modern, Western cultures) would be the population.

The strategy of observing a limited sample in order to generalize about a much larger population rests on the assumption that the sample is reasonably *representative* of the population. A sample is representative if its composition is similar to the composition of the population. ***Sampling bias* exists when a sample is not representative of the population from which it was drawn.** When a sample is not representative, generalizations about the population may be inaccurate. For instance, if a political pollster were to survey only people in posh shopping areas frequented by the wealthy, the pollster's generalizations about the voting public as a whole would be off the mark.


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Before accepting the results of a survey poll, one should know something about how the poll was conducted. A polling could, for instance, contain sampling bias. Opinions collected solely from middle-class people but generalized to the voting public as a whole would be an example of such bias.

As we discussed in Chapter 1, psychologists have historically tended to undersample women, ethnic minorities, and people from non-Western cultures. They have also tended to neglect older adults, while depending much too heavily on white middle- and upper-class college students. This excessive reliance on college students may not be all that problematic for some research questions, but it certainly seems likely to distort results in many research areas (Sears, 1986). In general, then, when you have doubts about the results of a study, the first thing to examine is the composition of the sample.

Placebo Effects

In pharmacology, a *placebo* is a substance that resembles a drug but has no actual pharmacological effect. In studies that assess the effectiveness of medications, placebos are given to some subjects to control for the effects of a treacherous extraneous variable: participants' expectations. Placebos are used because researchers know that participants' expectations can influence their feelings, reactions, and behavior (Stewart-Williams, 2004). **Thus, *placebo effects* occur when participants' expectations lead them to experience some change even though they receive empty, fake, or ineffectual treatment.** In medicine, placebo effects are well documented (Quitkin, 1999). Many physicians tell of patients being "cured" by prescriptions of sugar pills. Placebo effects have also been seen in laboratory experiments on the effects of alcohol. In these studies, some of the participants are led to believe that they are drinking alcoholic beverages when in reality the drinks only appear to contain alcohol. Many of the subjects show effects of intoxication even though they haven't really consumed any alcohol (Assefi & Garry, 2003). If you know someone who shows signs of intoxication as soon as they start drinking, before their alcohol intake could take effect physiologically, you have seen placebo effects in action.

In the realm of research the problem is that psychologists have found that participants' expectations can be powerful determinants of their perceptions and behavior when they are under the microscope in an empirical study. For example, placebo effects have been seen in research on meditation. A number

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of studies have found that meditation can improve people's energy level, mental and physical health, and happiness (Alexander et al., 1990; Reibel et al., 2001). However, in many of the early studies of meditation, researchers assembled their experimental groups with volunteer subjects eager to learn meditation. Most of these subjects *wanted* and *expected* meditation to have beneficial effects. Their positive expectations may have colored their subsequent ratings of their energy level, happiness, and so on. Better-designed studies have shown that meditation can be beneficial (see Chapter 5). However, placebo effects have probably exaggerated these benefits in some studies (Canter, 2003; Shapiro, 1987).

Researchers should guard against placebo effects whenever subjects are likely to have expectations that a treatment will affect them in a certain way. The possible role of placebo effects can be assessed by including a fake version of the experimental treatment (a placebo condition) in a study.

Distortions in Self-Report Data

Research psychologists often work with *self-report data,* consisting of subjects' verbal accounts of their behavior. This is the case whenever questionnaires, interviews, or personality inventories are used to measure variables. Self-report methods can be quite useful, taking advantage of the fact that people have a unique opportunity to observe themselves full-time (Baldwin, 2000). However, self-reports can be plagued by several kinds of distortion.

One of the most problematic of these distortions is **the *social desirability bias,* which is a tendency to give socially approved answers to questions about oneself.** Participants who are influenced by this bias try hard to create a favorable impression, especially when they are asked about sensitive issues (Tourangeau & Yan, 2007). For example, many survey respondents will report that they voted in an election, gave to a charity, or attend church regularly when in fact it is possible to determine that these assertions are untrue (Granberg & Holmberg, 1991; Hadaway, Marler, & Chaves, 1993). Respondents influenced by social desirability bias also tend to report that they are healthier, happier, and less prejudiced than other types of evidence would suggest. People who answer questions in socially desirable ways take slightly longer to respond to the questions, suggesting that they are carefully "editing" their responses (Holtgraves, 2004).

Other problems can also produce distortions in self-report data (Krosnick, 1999; Schuman & Kalton, 1985). Respondents misunderstand questionnaire items surprisingly often, and the way questions are worded can shape subjects' responses (Schwarz, 1999). Memory errors can undermine the accuracy of verbal reports. Response sets are yet another problem. **A *response set* is a tendency to respond to questions in a particular way that is unrelated to the content of the questions.** For example, some people tend to agree with nearly everything on a questionnaire (Krosnick & Fabrigar, 1998). Obviously, distortions like these can produce inaccurate results. Although researchers have devised ways to neutralize these problems—such as carefully pretesting survey instruments—we should be cautious in drawing conclusions from self-report data (Schaeffer, 2000).

Experimenter Bias

As scientists, psychologists try to conduct their studies in an objective, unbiased way so that their own views will not influence the results. However, objectivity is a *goal* that scientists strive for, not an accomplished fact that can be taken for granted (MacCoun, 1998). In reality, most researchers have an emotional investment in the outcome of their research. Often they are testing hypotheses that they have developed themselves and that they would like to see supported by the data. It is understandable, then, that *experimenter bias* is a possible source of error in research.

***Experimenter bias* occurs when a researcher's expectations or preferences about the outcome of a study influence the results obtained.** Experimenter bias can slip through to influence studies in many subtle ways. One problem is that researchers, like others, sometimes *see what they want to see*. For instance, when experimenters make apparently honest mistakes in recording subjects' responses, the mistakes tend to be heavily slanted in favor of supporting the hypothesis (O'Leary, Kent, & Kanowitz, 1975).

Research by Robert Rosenthal (1976) suggests that experimenter bias may lead researchers to unintentionally influence the behavior of their subjects. In a classic study, Rosenthal and Fode (1963) recruited undergraduate psychology students to serve as the "experimenters." The students were told that they would be collecting data for a study of how participants rated the success of people portrayed in photographs. In a pilot study, photos were selected that generated (on the average) neutral ratings on a scale extending from –10 (extreme failure) to +10 (extreme success). Rosenthal and Fode then manipulated the expectancies of their experimenters. Half of them were told that, based on pilot data, they would probably obtain average ratings of –5. The other half were led to expect average ratings of +5. The experimenters were forbidden from conversing with their sub-

Courtesy of Robert Rosenthal

Robert Rosenthal

"Quite unconsciously, a psychologist interacts in subtle ways with the people he is studying so that he may get the response he expects to get."

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ILLUSTRATED OVERVIEW OF KEY RESEARCH METHODS IN PSYCHOLOGY

RESEARCH METHOD

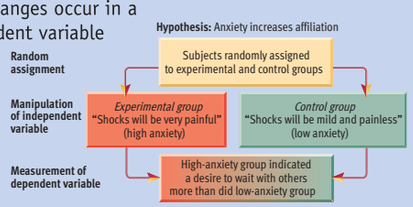
DESCRIPTION

EXAMPLE APPLIED TO RESEARCH ON AGGRESSION

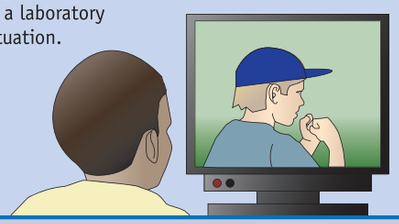
EXPERIMENT

Manipulation of an independent variable under carefully controlled conditions to see whether any changes occur in a dependent variable

Example: Schachter's (1959) study of whether increased anxiety leads to increased affiliation



Youngsters are randomly assigned to watch a violent or nonviolent film (manipulation of the independent variable), and some aspect of aggression (the dependent variable) is measured in a laboratory situation.



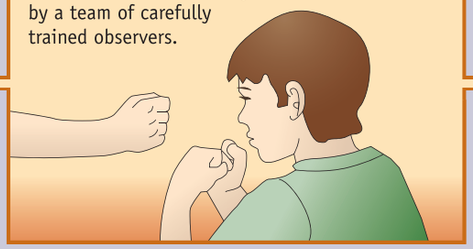
NATURALISTIC OBSERVATION

Careful, usually prolonged observation of behavior in its natural setting, without direct intervention

Example: Levine and Norenzayan's (1999) study comparing the pace of life in 31 countries

© Rob Crandall/Alamy

Youngsters' spontaneous acts of aggression during recreational activities on their playgound are recorded unobtrusively by a team of carefully trained observers.



CASE STUDIES

© David Buffinton/Photodisc Green/Getty Images

In-depth investigation of a single individual using direct interview, direct observation, review of records, interviews of those close to the person, and other data sources

Example: The Isometsa et al. (1995) study of all known suicide cases in Finland for an entire year

Detailed case histories are worked up for youngsters referred to counseling because of excessive aggressive behavior in school. The children are interviewed, as are their parents and teachers.

SURVEYS

Use of questionnaires or interviews to gather information about specific aspects of participants' behavior, attitudes, and beliefs

Example: Judge and Cable's (2004) analysis of questionnaire data on the correlation between height and income

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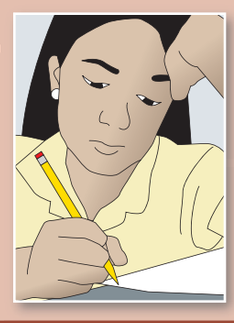
A large sample of youngsters are given a questionnaire describing hypothetical scenarios that might be expected to trigger aggressive behavior and are asked about how they think they would respond in the situations.



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ADVANTAGES	DISADVANTAGES
Precise control over variables can eliminate alternative explanations for findings. Researchers are able to draw conclusions about cause-and-effect relationships between variables.	Confounding of variables must be avoided. Contrived laboratory situations are often artificial, making it risky to generalize findings to the real world. Ethical concerns and practical realities preclude experiments on many important questions.
Artificiality that can be a problem in laboratory studies is minimized. It can be good place to start when little is known about the phenomena under study. Unlike other descriptive/correlational methods, it can be used to study animal as well as human behavior.	It can be difficult to remain unobtrusive; even animal behavior may be altererd by the observation process. Researchers are unable to draw causal conclusions. Observational data are often difficult to quantify for statistical analyses.
Case studies are well suited for study of psychological disorders and therapeutic practices. Individual cases can provide compelling illustrations to support or undermine a theory.	Subjectivity makes it easy to see what one expects to see based on one's theoretical slant. Researchers are unable to draw causal conclusions. Clinical samples are often unrepresentative and suffer from sampling bias.
Data collection can be relatively easy, saving time and money. Researchers can gather data on difficult-to-observe aspects of behavior. Questionnaires are well suited for gathering data on attitudes, values, and beliefs from large samples.	Self-report data are often unreliable, due to intentional deception, social desirability bias, response sets, memory lapses, and poor wording of questions. Researchers are unable to draw causal conclusions.

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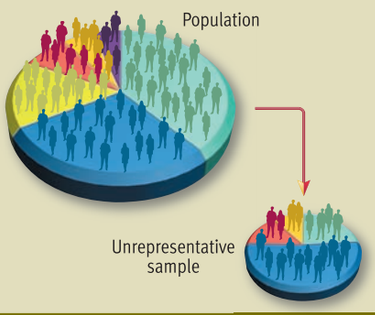

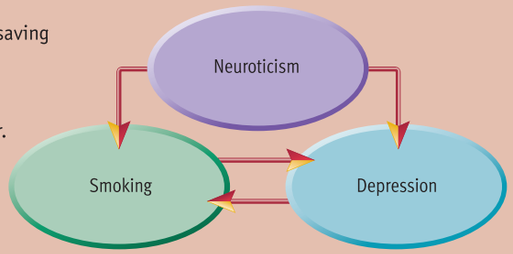

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concept check 2.4

Detecting Flaws in Research

Check your understanding of how to conduct sound research by looking for methodological flaws in the following studies. You'll find the answers in Appendix A.

Study 1. A researcher announces that he will be conducting an experiment to investigate the detrimental effects of sensory deprivation on perceptual-motor coordination. The first 40 students who sign up for the study are assigned to the experimental group, and the next 40 who sign up serve in the control group. The researcher supervises all aspects of the study's execution. Experimental subjects spend two hours in a sensory deprivation chamber, where sensory stimulation is minimal. Control subjects spend two hours in a waiting room that contains magazines and a TV. All subjects then perform ten 1-minute trials on a pursuit-rotor task that requires them to try to keep a stylus on a tiny rotating target. The dependent variable is their average score on the pursuit-rotor task.

Study 2. A researcher wants to know whether there is a relationship between age and racial prejudice. She designs a survey in which respondents are asked to rate their prejudice against six different ethnic groups. She distributes the survey to over 500 people of various ages who are approached at a shopping mall in a low-income, inner-city neighborhood.

Check the flaws that are apparent in each study.

Methodological flaw	Study 1	Study 2
Sampling bias		
Placebo effects		
Distortions in self-reports		
Confounding of variables		
Experimenter bias		

jects except for reading some standardized instructions. Even though the photographs were exactly the same for both groups, the experimenters who *expected* positive ratings *obtained* significantly higher ratings than those who expected negative ratings.

How could the experimenters have swayed the participants' ratings? According to Rosenthal, the experimenters may have unintentionally influenced their subjects by sending subtle nonverbal signals as the experiment progressed. Without realizing it, they may have smiled, nodded, or sent other positive cues when participants made ratings that were in line with the experimenters' expectations. Thus, experimenter bias may influence both researchers' observations and their subjects' behavior (Rosenthal, 1994, 2002).

The problems associated with experimenter bias can be neutralized by using a double-blind procedure. **The *double-blind procedure* is a research strategy in which neither participants nor experimenters know which subjects are in the experimental or control groups.** It's not particularly unusual for participants to be "blind" about their treatment condition. However, the double-blind procedure keeps the experimenter in the dark as well. Of course, a member of the research team who isn't directly involved with subjects keeps track of who is in which group.

REVIEW of Key Learning Goals

2.15 Scientists often try to replicate research findings to double-check their validity. Although this process leads to some contradictory findings, science works toward reconciling and explaining inconsistent results.

2.16 Sampling bias occurs when a sample is not representative of the population of interest. Placebo effects occur when participants' expectations cause them to change their behavior in response to a fake treatment.

2.17 Distortions in self-reports, such as response sets and the social desirability bias, are a source of concern whenever questionnaires and personality inventories are used to collect data. Experimenter bias occurs when researchers' expectations and desires distort their observations or unintentionally influence their subjects' behavior.

Key Learning Goals

2.18 Discuss the growth and the strengths and weaknesses of Internet-mediated research.

Looking into the Future: The Internet and Psychological Research

The Internet is revolutionizing many aspects of modern life. Some experts compare the emergence of the World Wide Web to the shift from speech to writing, the invention of the printing press, and the widespread distribution of electricity (Weiten, 2002). As Lenert and Skoczen (2002) note, "The Internet has profoundly changed how Americans communicate, obtain information, and conduct commerce" (p. 251). Small wonder then, that the Internet is gradually altering the ways in which psychological research is conducted.

***Internet-mediated research* refers to studies in which data collection occurs over the web.** All of the methods we have discussed in this chapter can be used in Internet-mediated research. Mostly, investigators have conducted online experiments and distributed online surveys. An example of a web experiment is a study by Goritz (2006) that compared various cash lottery incentives to see which would yield the highest response rates in online studies. An example of a web survey is a study by Tower and Krasner (2006), in which over 1100 on-

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line participants responded to measures of marital closeness and depressive symptoms to explore the correlation between marital adjustment and depression. Although experiments and surveys have dominated Internet-mediated research, the web has also afforded psychologists enlightening opportunities to engage in naturalistic observation of social interaction in online communities, such as chatrooms and newsgroups (Glaser & Kahn, 2005; McKenna & Bargh, 2000; McKenna & Seidman, 2005).

Why have researchers been drawn to the web? Because the Internet offers some enticing advantages in the data collection process. For example, studies conducted via the Internet can often obtain samples that are much larger and much more diverse than the samples typically used in laboratory research (Buchanan, 2000; Reips, 2007). If a researcher is interested in some special population, whether it be gamblers, steroid users, atheists, dentists, elderly marathon runners, or lesbians living in rural areas, creative recruitment via the Internet can yield sizable samples that would be difficult or impossible to obtain through traditional research procedures (Mathy et al., 2002; Skitka & Sargis, 2005). Moreover, once an online survey or experiment is set up, data can be collected effortlessly 24 hours a day, 7 days a week. Research assistants do not need to spend endless hours testing subjects in a lab, and participants' responses can be saved automatically into data files for statistical analyses. Thus, Internet-mediated research can reduce costs and save time (Goritz, 2007; Skitka & Sargis, 2006). Studies that might require six months or a year of data collection in the laboratory can sometimes be completed in a few weeks online.

As you can see, Internet-mediated research offers many attractive benefits, but this approach also has some weaknesses that concern researchers. One major concern is the potential for sampling bias. Although the population of web users grows daily, not everyone has access to the Internet. Web users tend to be younger, brighter, and more affluent than nonusers (Lenert & Skoczen, 2002). A related issue is that web studies tend to have lower participation rates than conventional studies (Skitka & Sargis, 2005). In laboratory studies, although subjects can always elect to not participate, the vast majority generally tend to go along with whatever study they are assigned to. In most web studies, broad invitations to participate are issued via e-mail or posted announcements, and only a small minority of potential subjects typically choose to volunteer their time. Researchers worry that their self-selected volunteers might be systematically different from the majority of people who, for one reason or another, chose not to participate. Sampling bias resulting from self-selection can also occur in lab research, but it appears to be a much more troublesome issue in Internet-mediated research. Web studies also tend to have higher dropout rates than laboratory studies, which provides another possible source of sampling bias (Birnbaum, 2004).

Another issue in Internet-mediated research is that data are collected under far less controlled conditions than in traditional studies (Buchanan, 2007; Hewson, 2003). Laboratory studies are conducted under carefully controlled conditions that are held constant for all participants. Researchers routinely obsess over details such as room temperature, lighting, and the gender of the research assistant who interacts with subjects. In contrast, subjects in web studies usually participate from home, where environmental conditions are uncontrolled and unknown. Some participants may be distracted by TV, some may sit around and discuss their data input with friends, some may provide data while intoxicated, and some may ignore crucial instructions. Similar problems can crop up in traditional approaches to research, such as when subjects fill out paper-and-pencil surveys at home. But lack of control appears to be a more serious problem for Internet-mediated research than conventional research.

So, given problems such as these, will Internet-mediated research turn out to be a temporary fad? Or will it become the wave of the future? It seems likely that Internet-mediated research will continue to grow. Although web studies have created some new complexities related to sampling bias, they appear to have the *potential* to yield more diverse and representative samples than traditional approaches to research (Hewson, 2003). The control problem seems more worrisome, but when investigators have run identical studies over the web and through traditional methods, the results have generally turned out to be highly similar (Birnbaum, 2004; McGraw, Tew, & Williams, 2000). These findings suggest that the control issue may be less problematic than feared. And while some researchers have expressed concern about the greater anonymity of participants in web studies, this increased anonymity actually may reduce the impact of social desirability bias (Hewson, 2007; Skitka & Sargis, 2006). In sum, it appears that the Internet will gradually alter the landscape of psychological research, just as it has altered the landscape of communication, shopping, politics, real estate, entertainment, and many other aspects of modern life.

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REVIEW of Key Learning Goals

2.18 Internet-mediated research has grown in recent years because it offers access to larger and more diverse samples and to specialized samples while reducing costs and saving time. However, Internet-mediated research raises its own concerns about sampling bias and uncontrolled conditions during data collection.

Key Learning Goals

2.19 Contrast the pros and cons of deception in research with human subjects.

2.20 Discuss the controversy about the use of animals as research subjects.

2.21 Summarize the major ethical principles governing psychological research.

Looking at Ethics: Do the Ends Justify the Means?

Think back to Stanley Schachter's (1959) study on anxiety and affiliation. Imagine how you would have felt if you had been one of the subjects in Schachter's high-anxiety group. You show up at a research laboratory, expecting to participate in a harmless experiment. The room you are sent to is full of unusual electronic equipment. An official-looking man in a lab coat announces that this equipment will be used to give you a series of painful electric shocks. His statement that the shocks will leave "no permanent tissue damage" is hardly reassuring. Surely, you think, there must be a mistake. All of a sudden, your venture into research has turned into a nightmare! Your stomach knots up in anxiety. The researcher explains that there will be a delay while he prepares his apparatus. He asks you to fill out a short questionnaire about whether you would prefer to wait alone or with others. Still reeling in dismay at the prospect of being shocked, you fill out the questionnaire. He takes it and then announces that you won't be shocked after all—it was all a hoax! Feelings of relief wash over you, but they're mixed with feelings of anger. You feel as though the experimenter has just made a fool out of you, and you're embarrassed and resentful.

Should researchers be allowed to play with your feelings in this way? Should they be permitted to deceive subjects in such a manner? Is this the cost that must be paid to advance scientific knowledge? As these questions indicate, the research enterprise sometimes presents scientists with difficult ethical dilemmas. *These dilemmas reflect concern about the possibility for inflicting harm on participants.* In psychological research, the major ethical dilemmas center on the use of deception and the use of animals.

web link 2.5

Bad Blood: The Tuskegee Syphilis Study

The enduring damage of unethical scientific and medical research—here seen in the infamous 1932–1972 Tuskegee Syphilis Study among 399 poor African-American men in Alabama—is detailed in several government reports and a rare presidential apology to the victims.

The Question of Deception

Elaborate deception, such as that seen in Schachter's study, has been fairly common in psychological research since the 1960s, especially in the area of social psychology (Epley & Huff, 1998; Korn, 1997). Over the years, psychologists have faked fights, thefts, muggings, faintings, epileptic seizures, rapes, and automobile breakdowns to explore a host of issues. They have led participants to believe that they were hurting others with electrical shocks, that they had homosexual tendencies, and that they were overhearing negative comments about themselves. Why have psychologists used so much deception in their research? Quite simply, they are trying to deal with the methodological problems discussed earlier. They often misinform participants about the purpose of a study to reduce problems resulting from placebo effects, the unreliability of self-reports, and the like that can undermine the scientific value and validity of research (Berghmans, 2007).

Critics argue against the use of deception on several grounds (Baumrind, 1985; Kelman, 1982; Ortmann & Hertwig, 1997). First, they assert that deception is only a nice word for lying, which they see as inherently immoral. Second, they argue that by deceiving unsuspecting participants, psychologists may undermine many individuals' trust in others. Third, they point out that many deceptive studies produce distress for participants who were not forewarned about that possibility. Specifically, subjects may experience great stress during a study or be made to feel foolish when the true nature of a study is explained.

Those who defend the use of deception in research maintain that many important issues could not be investigated if experimenters were not permitted to mislead participants (Bröder, 1998). They argue that most research deceptions involve "white lies" that are not likely to harm participants. Moreover, they point out that critics have *assumed* that deception studies are harmful to subjects, without collecting empirical data to document these detrimental effects. In reality, the relevant research suggests that deception studies are *not* harmful to participants (Christensen, 1988). Indeed, most subjects who participate in experiments involving deception report that they enjoyed the experience and that they didn't mind being misled. Moreover, the empirical evidence does not support the notions that deceptive research undermines subjects' trust in others or their respect for psychology or scientific re-

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search (Kimmel, 1996; Sharpe, Adair, & Roese, 1992). Curiously, the weight of the evidence suggests that researchers are more concerned about the negative effects of deception on participants than the participants themselves are (Fisher & Fyrberg, 1994; Korn, 1987). Finally, researchers who defend deception argue that the benefits—advances in knowledge that often improve human welfare—are worth the costs. They assert that it would be unethical *not* to conduct effective research on conformity, obedience, aggression, and other important social issues.

The issue of deception creates a difficult dilemma for scientists, pitting honesty against the desire to advance knowledge. Today, institutions that conduct research have committees that evaluate the ethics of research proposals before studies are allowed to proceed. These committees have often blocked studies requiring substantial deception. Many psychologists believe that this conservativism has obstructed important lines of research and slowed progress in the field. Although this belief may be true, it is not easy to write off the points made by the critics of deception. Warwick (1975) states the issue eloquently: "If it is all right to use deceit to advance knowledge, then why not for reasons of national security, for maintaining the Presidency, or to save one's own hide?" (p. 105). That's a tough question regarding a tough dilemma that will probably generate heated debate for a long time to come.

The Question of Animal Research

Psychology's other major ethics controversy concerns the use of animals in research. Psychologists use animals as research subjects for several reasons. Sometimes they simply want to know more about the behavior of a specific type of animal. In other instances, they want to see whether certain laws of behavior apply to both humans and animals. Finally, in some cases psychologists use animals because they can expose them to treatments that clearly would be unacceptable with human subjects. For example, most of the research on the relationship between deficient maternal nutrition during pregnancy and the incidence of birth defects has been done with animals.

It's this third reason for using animals that has generated most of the controversy. Some people maintain that it is wrong to subject animals to harm or pain for research purposes. Essentially, they argue that animals are entitled to the same rights as humans (Regan, 1997; Ryder, 2006). They accuse researchers of violating these rights by subjecting animals to unnecessary cruelty in many "trivial" studies (Bowd & Shapiro, 1993; Hollands, 1989). They also assert that most animal studies are a waste of time because the results may not even apply to humans (Millstone, 1989; Norton, 2005). For example, Ulrich (1991) argues that "pigeons kept confined at 80% body weight in home cages that don't allow them ever to spread their wings, take a bath, or relate socially to other birds provide questionable models for humans" (pp. 200–201).

Although some animal rights activists simply advocate more humane treatment of research animals, a survey of 402 activists questioned at a Washington, D.C. rally found that 85% wanted to eliminate *all* research with animals (Plous, 1991). Some of the more militant animal rights activists have broken into

web link 2.6

Animal Welfare Information Center

This site, maintained by the U.S. Department of Agriculture, is an excellent source for information relating to all aspects of how animals are (and should be) cared for in research, laboratory, and other settings.

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Many important scientific discoveries have been achieved through animal research, as the advertisement on the left notes. But many people remain vigorously opposed to animal research. The animal liberation activist shown here was covered in fake blood and strapped to a giant vivisection board as part of a protest against animal research in Melbourne, Australia. Clearly, the ethics of animal research is a highly charged controversy.

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laboratories, destroyed scientists' equipment and research records, and stolen experimental animals. The animal rights movement has enjoyed considerable success. For example, membership in People for the Ethical Treatment of Animals (PETA) grew from 8,000 in 1984 to 750,000 in 2003 (Herzog, 2005). David Johnson (1990) noted that "the single issue citizens write about most often to their congresspersons and the president is not homelessness, not the drug problem, not crime. It is animal welfare" (p. 214).

In spite of the great furor, only 7%–8% of all psychological studies involve animals (mostly rodents and birds). Relatively few of these studies require subjecting the animals to painful or harmful manipulations (American Psychological Association, 1984). Psychologists who defend animal research point to the major advances attributable to psychological research on animals, which many people are unaware of (Baldwin, 1993; Compton, Dietrich, & Smith, 1995; Paul & Paul, 2001). Among them are advances in the treatment of mental disorders, neuromuscular disorders, strokes, brain injuries, visual defects, headaches, memory defects, high blood pressure, and problems with pain (Carroll & Overmier, 2001; Domjan & Purdy, 1995). To put the problem in context, Neal Miller (1985), a prominent psychologist who has done pioneering work in several areas, noted the following:

At least 20 million dogs and cats are abandoned each year in the United States; half of them are killed in pounds and shelters, and the rest are hit by cars or die of neglect. Less than 1/10,000 as many dogs and cats were used in psychological laboratories. . . . Is it worth sacrificing the lives of our children in order to stop experiments, most of which involve no pain, on a vastly smaller number of mice, rats, dogs, and cats? (p. 427)

Far more compelling than Miller are the advocates for disabled people who have entered the fray to campaign against the animal rights movement in recent years. For example, Dennis Feeney (1987), a psychologist disabled by paraplegia, quotes a newsletter from an organization called The Incurably Ill for Animal Research:

No one has stopped to think about those of us who are incurably ill and are desperately waiting for new research results that can only be obtained through the use of animals. We have seen successful advances toward other diseases, such as polio, diphtheria, mumps, measles, and hepatitis through animal research. We want the same chance for a cure, but animal rights groups would deny us this chance. (p. 595)

As you can see, the manner in which animals can ethically be used for research is a highly charged controversy. Psychologists are becoming increasingly sensitive to this issue. Although animals continue to be used in research, strict regulations have been imposed that govern nearly every detail of how laboratory animals can be used for research purposes (Ator, 2005; Garnett, 2005).

Ethical Principles in Research

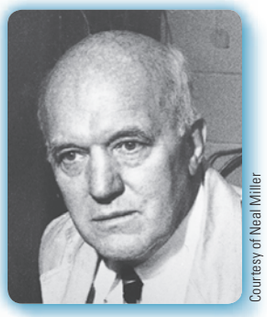
The ethics issues that we have discussed in this section have led the APA to develop a set of ethical standards for researchers (American Psychological Association, 2002; see **Figure 2.17**). Although most psychological studies are fairly benign, these ethical principles are intended to ensure that both human and animal subjects are treated with dignity. Some of the most important guidelines for research with human participants include the following: (1) people's participation in research should always be voluntary and they should be allowed to withdraw from a study at any time; (2) participants should not be subjected to harmful or dangerous treatments; (3) if a study requires deception, participants should be debriefed (informed of the true nature and purpose of the research) as soon as possible; and (4) particpants' right to privacy should never be compromised. Crucial guidelines for research with animals include (1) harmful or painful procedures cannot be justified unless the potential benefits of the research are substantial, and (2) research animals are entitled to decent living conditions.

In regard to research ethics, the newest source of concern and debate centers on social scientists' increased use of the Internet as a tool for collecting data (Ess, 2007; Keller & Lee, 2003; Pittenger, 2003). As we have discussed, the emergence of the Internet has created a variety of new opportunities for behavioral researchers. For instance, chatrooms and other types of virtual communities provide remarkable opportunities for naturalistic observation of group processes in action. Psychologists are moving quickly to take advantage of these opportunities, but this new venue for research sometimes raises complicated questions about how the APA's ethical guidelines should be applied. Is interaction on the Internet similar to interaction in a public location like a park or sidewalk, open to observation? Or is it more like interaction on a phone line where one would expect some privacy? Is it acceptable for researchers to lurk in chat rooms and systematically record interactions? What if they pose as group members and provoke discussion of specific issues? If an Internet

web link 2.7

Office of Research Integrity

Anyone who needs a comprehensive, up-to-date overview of ethical concerns in research from the perspective of the U.S. government should consider visiting this site. Although the Office of Research Integrity (ORI) deals with research sponsored by the U.S. Public Health Service, it also offers links to parallel offices and resources in many other agencies.



Courtesy of Neal Miller

Neal Miller

"Who are the cruel and inhumane ones, the behavioral scientists whose research on animals led to the cures of the anorexic girl and the vomiting child, or those leaders of the radical animal activists who are making an exciting career of trying to stop all such research and are misinforming people by repeatedly asserting that it is without any value?"

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APA Ethical Guidelines for Research

1. A subject's participation in research should be voluntary and based on informed consent. Subjects should never be coerced into participating in research. They should be informed in advance about any aspects of the study that might be expected to influence their willingness to cooperate. Furthermore, they should be permitted to withdraw from a study at any time if they so desire.

2. Participants should not be exposed to harmful or dangerous research procedures. This guideline is intended to protect subjects from psychological as well as physical harm. Thus, even stressful procedures that might cause emotional discomfort are largely prohibited. However, procedures that carry a modest risk of moderate mental discomfort may be acceptable.

3. If an investigation requires some deception of participants (about matters that do not involve risks), the researcher is required to explain and correct any misunderstandings as soon as possible. The deception must be disclosed to subjects in "debriefing" sessions as soon as it is practical to do so without compromising the goals of the study.

4. Subjects' rights to privacy should never be violated. Information about a subject that might be acquired during a study must be treated as highly confidential and should never be made available to others without the consent of the participant.

5. Harmful or painful procedures imposed upon animals must be thoroughly justified in terms of the knowledge to be gained from the study. Furthermore, laboratory animals are entitled to decent living conditions that are spelled out in detailed rules that relate to their housing, cleaning, feeding, and so forth.

6. Prior to conducting studies, approval should be obtained from host institutions and their research review committees. Research results should be reported fully and accurately, and raw data should be promptly shared with other professionals who seek to verify substantive claims. Retractions should be made if significant errors are found in a study subsequent to its publication.

Figure 2.17
Ethics in research. Key ethical principles in psychological research, as set forth by the American Psychological Association (2002), are summarized here. These principles are meant to ensure the welfare of both human and animal subjects.

study includes deception, then participants must be debriefed. But given the anonymity of the Internet, how can researchers debrief subjects who abandon their study midway and cannot be located? As you can see, Internet-mediated research poses complex new ethical dilemmas for researchers.

REVIEW of Key Learning Goals

2.19 Critics argue that deception in research is unethical because it is inherently immoral, may undermine participants' trust in others, and may expose them to high levels of stress. Those who defend deception in research argue that many important issues could not be investigated without misleading subjects and that the negative effects of deception on participants have been overestimated.

2.20 Critics of animal research argue that it violates animals' rights and that the findings of animal studies may not generalize to humans. Psychologists who defend animal research argue that it has brought major advances that are worth the costs.

2.21 The APA has formulated ethical principles to serve as guidelines for researchers. Human subjects' participation should be voluntary, they should not be exposed to harmful treatments, they should be debriefed about deception, and their privacy should be respected. Animal subjects are entitled to decent living conditions and should not be exposed to dangerous procedures unless the potential benefits of the research are substantial.

Reflecting on the Chapter's Themes

Key Learning Goals

2.22 Identify the two unifying themes highlighted in this chapter.

Two of our seven unifying themes emerged strongly in this chapter. First, the entire chapter is a testimonial to the idea that psychology is empirical. Second, we saw numerous examples of how people's experience of the world can be highly subjective. Let's examine each of these points in more detail.

As explained in Chapter 1, the empirical approach entails testing ideas, basing conclusions on systematic observation, and relying on a healthy brand of skepticism. All those features of the empirical approach have been apparent in our review of the research enterprise in psychology.

As you have seen, psychologists test their ideas by formulating clear hypotheses that involve predictions about relations between variables. They then use a variety of research methods to collect data so they can see whether their predictions are supported. The data collection methods are designed to make researchers' observations systematic and precise. The entire venture is saturated with skepticism. Psychologists are impressed only by research results that are highly unlikely to have occurred by chance. In planning and executing their research, they are constantly on the lookout for methodologi-

Empiricism

Subjectivity of Experience

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cal flaws. They submit their articles to a demanding peer review process so that other experts can subject their methods and conclusions to critical scrutiny. Collectively, these procedures represent the essence of the empirical approach.

The subjectivity of personal experience was apparent in our discussion of how adversaries overestimate the gap between their views, and in our Featured Study, which showed that two people experiencing the same event can have different feelings about it because of differing expectations. Subjective perception was also prominent in our coverage of methodological problems, especially placebo effects and experimenter bias. When subjects report beneficial effects from a fake treatment (the placebo), it's because they expected to see these effects. As pointed out in Chapter 1, psychologists and other scientists are not immune to the effects of subjective experience. Although they are trained to be objective, even scientists may see what they expect to see or what they want to see. This is one reason that the empirical approach emphasizes precise measurement and a skeptical attitude. The highly subjective nature of experience is exactly what the empirical approach attempts to neutralize.

The publication of empirical studies allows us to apply a critical eye to the research enterprise. However, you cannot critically analyze studies unless you know where and how to find them. In the upcoming Personal Application, we will discuss where studies are published, how to find studies on specific topics, and how to read research reports. In the subsequent Critical Thinking Application, we'll analyze the shortcomings of anecdotal evidence, which should help you to appreciate the value of empirical evidence.

REVIEW of Key Learning Goals

2.22 The empirical nature of psychology was elucidated throughout this chapter. Empiricism involves testing hypotheses, basing conclusions on systematic observation, and taking a skeptical approach. The chapter also showed repeatedly that our experience of the world is highly subjective.

PERSONAL APPLICATION

Key Learning Goals

2.23 Characterize the nature of technical journals.

2.24 Explain how to use PsycINFO to search for research literature in psychology.

2.25 Describe the standard organization of journal articles reporting on empirical research.

Finding and Reading Journal Articles

Answer the following "yes" or "no."

___ **1** I have read about scientific studies in newspapers and magazines and sometimes wondered, "How did they come to those conclusions?"

___ **2** When I go to the library, I often have difficulty figuring out how to find information based on research.

___ **3** I have tried to read scientific reports and found them to be too technical and difficult to understand.

If you responded "yes" to any of the above statements, you have struggled with the information explosion in the sciences. We live in a research-oriented society. The number of studies conducted in most sciences is growing at a dizzying pace. This expansion has been particularly spectacular in psychology. Moreover, psychological research increasingly commands attention from the popular press because it is often relevant to people's personal concerns.

This Personal Application is intended to help you cope with the information explosion in psychology. It assumes that there may come a time when you need to examine original psychological research. Perhaps it will be in your role as a student (working on a term paper, for instance), in another role (parent, teacher, nurse, administrator), or merely out of curiosity. In any case, this Application explains the nature of technical journals and discusses how to find and read articles in them. You can learn more about how to use library resources in psychology from an excellent little book titled *Library Use: A Handbook for Psychology* (Reed & Baxter, 2003).

The Nature of Technical Journals

As you will recall from earlier in the chapter, a *journal* is a periodical that publishes technical and scholarly material, usually in a narrowly defined area of inquiry. Scholars in most fields—whether economics, chemistry, education, or psychology—publish the bulk of their work in these journals. Journal articles represent the core of intellectual activity in any academic discipline. Although they are periodicals, you generally will not find technical journals at your local newsstand. Even public libraries carry relatively few professional journals. Academic libraries and professors account for the vast majority of subscriptions to technical journals. Individual professors typically subscribe to five to ten journals that publish articles in their area of expertise, whereas large college libraries subscribe to thousands of professional journals.

In general, journal articles are written for other professionals in the field. Hence, authors assume that their readers are other interested economists or chemists or psychologists. Because journal articles are written in the special language unique to a particular discipline, they are often difficult for nonprofessionals to understand. You

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will be learning a great deal of psychology's special language in this course, which will improve your ability to understand articles in psychology journals.

In psychology, most journal articles are reports that describe original empirical studies. These reports permit researchers to disseminate their findings to the scientific community. Another common type of article is the review article. *Review articles* summarize and reconcile the findings of a large number of studies on a specific issue. Some psychology journals also publish comments or critiques of previously published research, book reviews, theoretical treatises, and descriptions of methodological innovations.

Finding Journal Articles

Reports of psychological research are commonly mentioned in newspapers and popular magazines. These summaries can be helpful to readers, but they often embrace the most sensational conclusions that might be drawn from the research. They also tend to include many oversimplifications and factual errors. Thus, if a study mentioned in the press is of interest to you, you may want to track down the original article to ensure that you get accurate information.

Most discussions of research in the popular press do not mention where you can find the original technical article. However, there is a way to find out. A computerized database called PsycINFO makes it possible to locate journal articles by specific researchers or scholarly work on specific topics. This huge online database, which is updated constantly, contains brief summaries, or *abstracts,* of journal articles, books, and chapters in edited books, reporting, reviewing, or theorizing about psychological research. Over 2100 journals are checked regularly to select items for inclusion. The abstracts are concise—about 75 to 175 words. They briefly describe the hypotheses, methods, results, and conclusions of the studies. Each abstract should allow you to determine whether an article is relevant to your interests. If it is, you should be able to find the article in your library (or to order it) because a complete bibliographic reference is provided.

PsycINFO: Search Results

Your query: ((timothy judge):author) AND (2004<=Year<=2004)
Results: 12 documents

1. **Intelligence and Leadership: A Quantitative Review and Test of Theoretical Propositions.**
By Judge, Timothy A.; Colbert, Amy E.; Ilies, Remus
Journal of Applied Psychology. 89(3), Jun 2004, 542–552.
Citation and Abstract | Expanded Record | Expanded Record with References | View Article (HTML) | View Article (PDF)
2. **The Effect of Physical Height on Workplace Success and Income: Preliminary Test of a Theoretical Model.**
By Judge, Timothy A.; Cable, Daniel M.
Journal of Applied Psychology. 89(3), Jun 2004, 428–441.
Citation and Abstract | Expanded Record | Expanded Record with References | View Article (HTML) | View Article (PDF)
3. **Organizational Justice and Stress: The Mediating Role of Work-Family Conflict.**
By Judge, Timothy A.; Colquitt, Jason A.
Journal of Applied Psychology. 89(3) Jun 2004, 395–404.
Citation and Abstract | Expanded Record | Expanded Record with References | View Article (HTML) | View Article (PDF)
4. **Employee attitudes and job satisfaction.**
By Saari, Lise M.; Judge, Timothy A.
Human Resource Management. 43(4), Win 2004, 395–407.
Citation and Abstract | Expanded Record | Expanded Record with References
5. **Personality and Transformational and Transactional Leadership: A Meta-Analysis.**
By Bono, Joyce E.; Judge, Timothy A.
Journal of Applied Psychology. 89(5) Oct 2004, 901–910.
Citation and Abstract | Expanded Record | Expanded Record with References | View Article (HTML) | View Article (PDF)
6. **Transformational and Transactional Leadership: A Meta-Analytic Test of Their Relative Validity.**
By Judge, Timothy A.; Piccolo, Ronald F.
Journal of Applied Psychology. 89(5) Oct 2004, 755–768.
Citation and Abstract | Expanded Record | Expanded Record with References | View Article (HTML) | View Article (PDF)

Figure 2.18

Searching PsycINFO. If you searched PsycINFO for journal articles published by Timothy Judge during 2004, the database would return 12 listings, of which the first 6 are shown here. For each article, you can click to see its abstract or its full PsycINFO record (the abstract plus subject descriptors and other details). In some cases (depending on the version of PsycINFO that your library has ordered) you can click to see the full PsycINFO record plus references, or the *full text* of some articles.

SOURCE: Sample search reprinted with permission of the American Psychological Association, publisher of the PsycINFO® database. Copyright © 1887–present, American Psychological Association. All rights reserved. For more information contact psycinfo.apa.org.

Although news accounts of research rarely mention where a study was published, they often mention the name of the researcher. If you have this information, the easiest way to find a specific article is to search PsycINFO for materials published by that researcher. For example, let's say you read a news report that summarized the survey study that we described earlier on the correlation between height and income (Judge & Cable, 2004; see p. 53). Let's assume that the news report mentioned the name of Timothy Judge as the lead author and indicated that the article was published in 2004. To track down the original article, you would search for journal articles published by Timothy Judge in 2004. If you conducted this search, you would turn up a list of 12 articles. The information for the first six articles in this list is shown in **Figure 2.18**. The second item in the list appears to be the article you are interested in. **Figure 2.19** on the next page shows what you would see if you clicked to obtain the Citation and Abstract for this article. As you can see, the abstract shows that the original report was published in the June 2004 issue of the *Journal of Applied Psychology*. Armed with this information, you could obtain the article easily.

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PsycINFO
Your source for psychological abstracts

PsycINFO: Citation and Abstract

Title	The Effect of Physical Height on Workplace Success and Income: Preliminary Test of a Theoretical Model.
Abstract	In this article, the authors propose a theoretical model of the relationship between physical height and career success. We then test several linkages in the model based on a meta-analysis of the literature, with results indicating that physical height is significantly related to measures of social esteem (p = .41), leader emergence (p = .24), and performance (p = .18). Height was somewhat more strongly related to success for men (p = .29) than for women (p = .21), although this difference was not significant. Finally, given that almost no research has examined the relationship between individuals' physical height and their incomes, we present four large-sample studies (total N = 8,590) showing that height is positively related to income (b = .26) after controlling for sex, age, and weight. Overall, this article presents the most comprehensive analysis of the relationship of height to workplace success to date, and the results suggest that tall individuals have advantages in several important aspects of their careers and organizational lives (PsycINFO Database Record © 2004 APA, all rights reserved)
Authors	Judge, Timothy A.; Cable, Daniel N.
Affiliations	Judge, Timothy A.: Department of Management, Warrington College of Business, University of Florida, FL, US Cable, Daniel M.: Kenan-Flagler Business School, University of North Carolina, NC, US
Source	Journal of Applied Psychology. 89(3), Jun 2004, 428–441.

Figure 2.19

Example of a PsycINFO abstract. This information is what you would see if you clicked to see the abstract of item 2 in the list shown in Figure 2.18. It is a typical abstract from the online PsycINFO database. Each abstract in PsycINFO provides a summary of a specific journal article, book, or chapter in an edited book, and complete bibliographical information.

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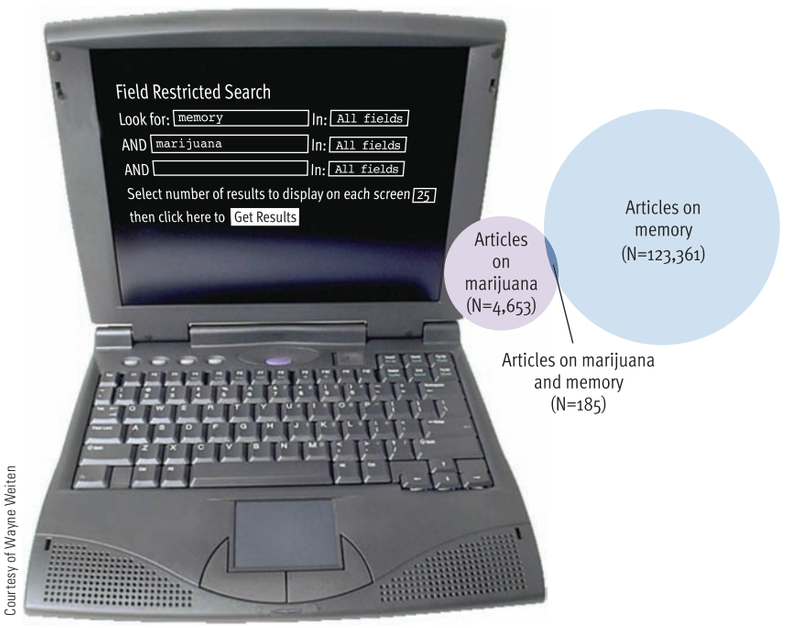
You can also search PsycINFO for research literature on particular topics, such as achievement motivation, aggressive behavior, alcoholism, appetite disorders, or artistic ability. These computerized literature searches can be much more powerful, precise, and thorough than traditional, manual searches in a library. PsycINFO can sift through several million articles in a matter of seconds to identify *all* the articles on a subject, such as alcoholism. Obviously, there is no way you can match this efficiency stumbling around in the stacks at your library. Moreover, the computer allows you to pair up topics to swiftly narrow your search to exactly those issues that interest you. For example, **Figure 2.20** shows a PsycINFO search that identified all the articles on marijuana *and* memory. If you were preparing a term paper on whether marijuana affects memory, this precision would be invaluable.

The PsycINFO database can be accessed online through many libraries or via the Internet (see Web Link 2.2 for a description of PsycINFO Direct). The summaries contained in PsycINFO formerly were also found in a monthly print journal called *Psychological Abstracts*. However, the publication of this journal was discontinued in 2006 after 80 years of service as it became an antiquated source of information in comparison to the PsycINFO database (Benjamin & Vanden-Bos, 2006).

Reading Journal Articles

Once you find the journal articles you want to examine, you need to know how to decipher them. You can process the in-



Courtesy of Wayne Weiten

Figure 2.20

Combining topics in a PsycINFO search. A computerized literature search can be a highly efficient way to locate the specific research that you need. For example, if you had set out in November of 2007 to find all the journal articles on marijuana and memory using PsycINFO, you would have obtained the results summarized here. At that time, the database contained 123,361 articles related to memory and 4,653 articles related to marijuana. The search depicted on the left yielded 185 abstracts that relate to both marijuana and memory. Thus, in a matter of moments, the computer can sift through over 2 million abstracts to find those that are most germane to a specific question, such as: Does marijuana affect memory?

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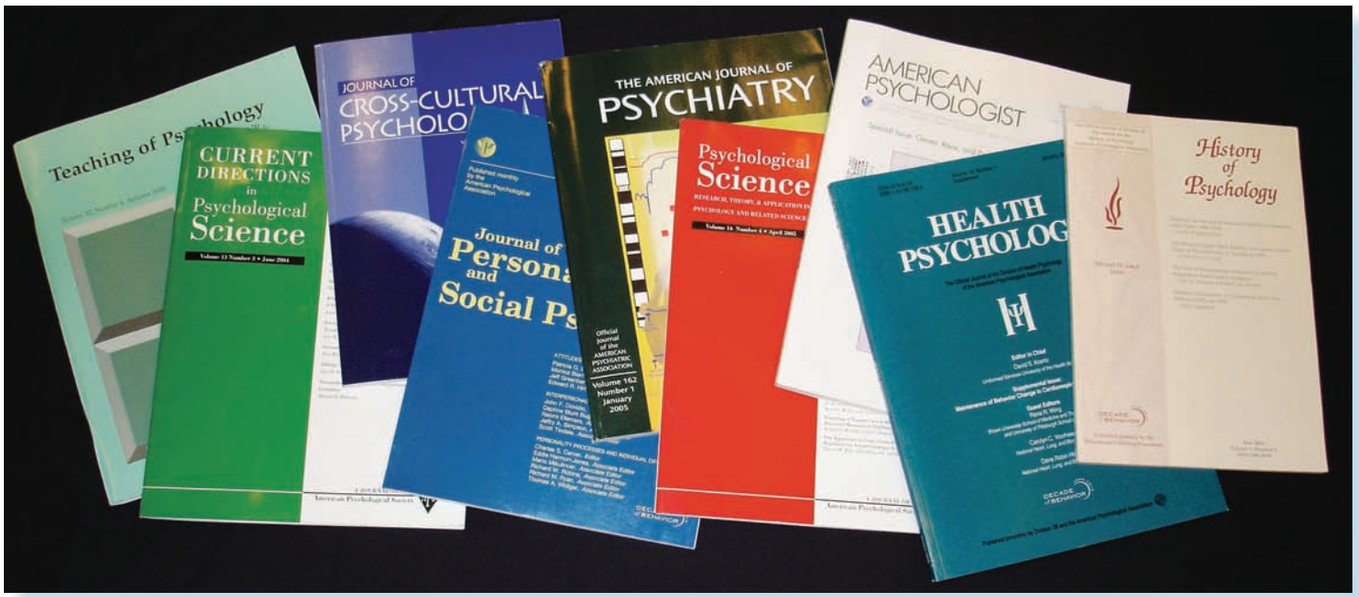

formation in such articles more efficiently if you understand how they are organized. Depending on your needs and purpose, you may want to simply skim through some of the sections. Journal articles follow a fairly standard organization, which includes the following sections and features.

Abstract

Most journals print a concise summary at the beginning of each article. This abstract allows readers scanning the journal to quickly decide whether articles are relevant to their interests.

Introduction

The introduction presents an overview of the problem studied in the research. It mentions relevant theories and quickly reviews previous research that bears on the problem, usually citing shortcomings in previous research that necessitate the present study. This review of the current state of knowledge on the topic usually progresses to a specific and precise statement regarding the hypotheses under investigation.

Method

The method section provides a thorough description of the research methods used in the study. Information is provided on the subjects used, the procedures followed, and the data collection techniques employed. This description is made detailed enough to permit another researcher to attempt to replicate the study.

Results

The data obtained in the study are reported in the results section. This section often creates problems for novice readers because it includes complex statistical analyses, figures, tables, and graphs. This section does *not* include any inferences based on the data, as such conclusions are supposed to follow in the next section. Instead, it simply contains a concise summary of the raw data and the statistical analyses.

Discussion

In the discussion section you will find the conclusions drawn by the author(s). In contrast to the results section, which is a straightforward summary of empirical observations, the discussion section allows for interpretation and evaluation of the data. Implications for theory and factual knowledge in the discipline are discussed. Conclusions are usually qualified carefully, and any limitations in the study may be acknowledged. This section may also include suggestions for future research on the issue.

References

At the end of each article you will find a list of bibliographic references for any studies cited. This list permits you to examine first-hand other relevant studies mentioned in the article. The references list is often a rich source of leads about other articles that are germane to the topic that you are looking into.

REVIEW of Key Learning Goals

2.23 Journals publish technical and scholarly material. Usually they are written for other professionals in a narrow area of inquiry. In psychology, most journal articles are reports of original research. Subscriptions to journals are mostly held at academic libraries.

2.24 PsycINFO is a computerized database that contains brief summaries of newly published journal articles, books, and chapters in edited books. Works on specific topics and publications by specific authors can be found by using the search mechanisms built into the database. Computerized literature searches can be much more powerful and precise than manual searches.

2.25 Journal articles are easier to understand if one is familiar with the standard format. Most articles include six elements: abstract, introduction, method, results, discussion, and references.

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CRITICAL THINKING

APPLICATION

Key Learning Goals

2.26 Recognize anecdotal evidence and understand why it is unreliable.

The Perils of Anecdotal Evidence: "I Have a Friend Who . . ."

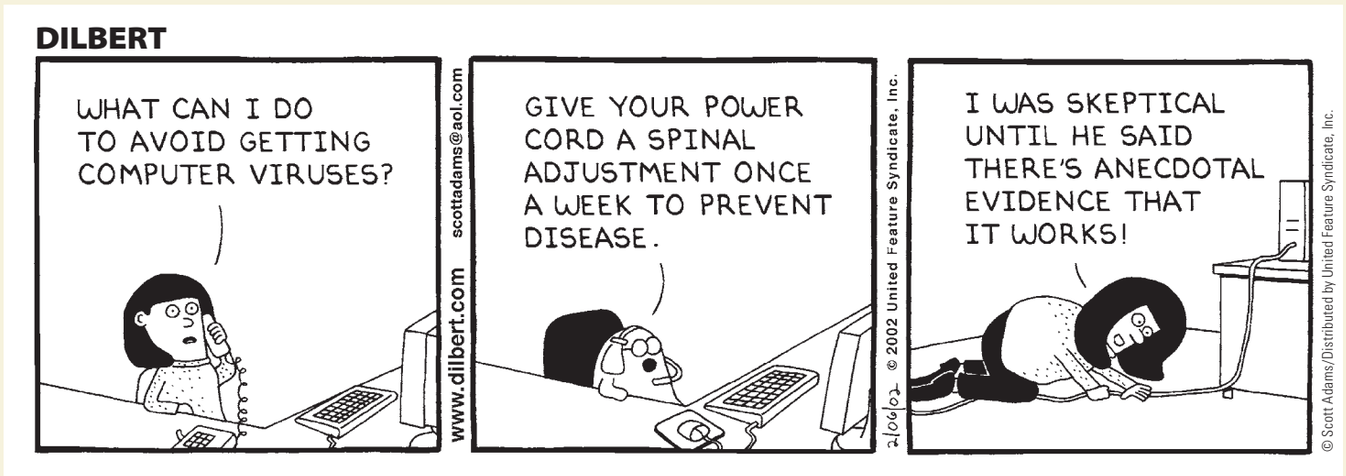
Here's a tough problem. Suppose you are the judge in a family law court. As you look over the cases that will come before you today, you see that one divorcing couple have managed to settle almost all of the important decisions with minimal conflict—such as who gets the house, who gets the car and the dog, and who pays which bills. However, there is one crucial issue left: Each parent wants custody of the children, and because they could not reach an agreement on their own, the case is now in your court. You will need the wisdom of the legendary King Solomon for this decision. How can you determine what is in the best interests of the children?

Child custody decisions have major consequences for all of the parties involved. As you review the case records, you see that both parents are loving and competent, so there are no obvious reasons for selecting one parent over the other as the primary caretaker. In considering various alternatives, you mull over the possibility of awarding *joint custody,* an arrangement in which the children spend half their time with each parent, instead of the more usual arrangement where one parent has primary custody and the other has visitation rights. Joint custody seems to have some obvious benefits, but you are not sure how well these arrangements actually work. Will the children feel more attached to both parents if the parents share custody equally? Or will the children feel hassled by always moving around, perhaps spending half the week at one parent's home and half at the other parent's home? Can parents who are already feuding over child custody issues make these complicated arrangements work? Or is joint custody just too disruptive to everyone's life? You really don't know the answer to any of these vexing questions.

One of the lawyers involved in the case knows that you are thinking about the possibility of joint custody. She also understands that you want more information about how well joint custody tends to work before you render a decision. To help you make up your mind, she tells you about a divorced couple that has had a joint custody arrangement for many years and offers to have them appear in court to describe their experiences "firsthand." They and their children can answer any questions you might have about the pros and cons of joint custody. They should be in the best position to know how well joint custody works because they are living it. Sounds like a reasonable plan. What do you think?

I hope you said, "No, no, no!" What's wrong with asking someone who's been there how well joint custody works? The crux of the problem is that the evidence a single family brings to the question of joint custody is ***anecdotal evidence,*** **which consists of personal stories about specific incidents and experiences.** Anecdotal evidence can be seductive. For example, one study found that psychology majors' choices of future courses to enroll in were influenced more by a couple of students' brief anecdotes than by extensive statistics on many other students' ratings of the courses from the previous term (Borgida & Nisbett, 1977). Anecdotes readily sway people because they are often concrete, vivid, and memorable. Indeed, people tend to be influenced by anecdotal information even when they are explicitly forewarned that the information is *not* representative (Hammill, Wilson, & Nisbett, 1980). Many politicians are keenly aware of the power of anecdotes and frequently rely on a single vivid story rather than solid data to sway voters' views. However, anecdotal evidence is fundamentally flawed (Ruscio, 2006; Stanovich, 2004).

What, exactly, is wrong with anecdotal evidence? Let's use some of the concepts introduced in the main body of the chapter to analyze its shortcomings. First, in the language of research designs, the anecdotal experiences of one family resemble a single *case study.* The story they tell about their experiences with joint custody may be quite interesting, but their experiences—



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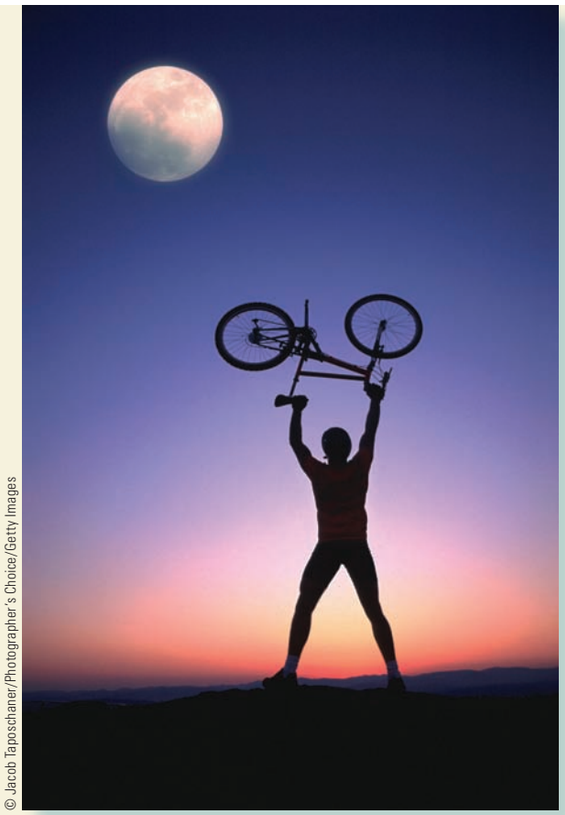

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An abundance of anecdotal reports suggest that there is an association between the full moon and strange, erratic behavior. These reports often sound compelling, but as the text explains, anecdotal evidence is flawed in many ways. When researchers have examined the issue systematically, they have consistently found no association between lunar phases and the incidence of psychiatric emergencies, domestic violence, suicide, and so forth. (Biermann et al., 2005; Chudler, 2007; Dowling, 2005; Kung & Mrazek, 2005; McLay, Daylo, & Hammer, 2006).

good or bad—cannot be used to generalize to other couples. Why not? Because they are only one family, and they may be unusual in some way that affects how well they manage joint custody. To draw general conclusions based on the case study approach, you need a systematic series of case studies, so you can look for threads of consistency. A single family is a sample size of one, which surely is not large enough to derive broad principles that would apply to other families.

Second, anecdotal evidence is similar to *self-report data,* which can be distorted for a variety of reasons, such as people's tendency to give socially approved information about themselves (the *social desirability bias*). When researchers use tests and surveys to gather self-report data, they can take steps to reduce or assess the impact of distortions in their data, but there are no comparable safeguards with anecdotal evidence. Thus, the family that appears in your courtroom may be eager to make a good impression and unknowingly slant their story accordingly.

Anecdotes are often inaccurate and riddled with embellishments. We will see in Chapter 7 that memories of personal experiences are far more malleable and far less reliable than widely assumed (Loftus, 2004; Schacter, 2001). And, although it would not be an issue in this case, in other situations *anecdotal evidence often consists of stories that people have heard about others' experiences.* Hearsay evidence is not accepted in courtrooms for good reason. As stories are passed on from one person to another, they often become increasingly distorted and inaccurate.

Can you think of any other reasons for being wary of anecdotal evidence? After reading the chapter, perhaps you thought about the possibility of *sampling bias.* Do you think that the lawyer will pick a couple at random from all those who have been awarded joint custody? It seems highly unlikely. If she wants you to award joint custody, she will find a couple for whom this arrangement worked very well, while if she wants you to award sole custody to her client, she will find a couple whose inability to make joint custody work had dire consequences for their children. One reason people love to work with anecdotal evidence is that it is so readily manipulated; they can usually find an anecdote or two to support their position, whether or not these anecdotes are representative of most people's experiences.

If the testimony of one family cannot be used in making this critical custody decision, what sort of evidence should you be looking for? One goal of effective critical thinking is to make decisions based on solid evidence. This process is called *evidence-based decision making.* In this case, you would need to consider the overall experiences of a large sample of families who have tried joint custody arrangements. In general, across many different families, did the children in joint custody develop well? Was there a disproportionately high rate of emotional problems or other signs of stress for the children or the parents? Was the percentage of families who returned to court at a later date to change their joint custody arrangements higher than for other types of custody arrangements? You can probably think of additional information that you would want to collect regarding the outcomes of various custody arrangements.

In examining research reports, many people recognize the need to evaluate the evidence by looking for the types of flaws described in the main body of the chapter (sampling bias, experimenter bias, and so forth). Curiously, though, many of the same people then fail to apply the same principles of good evidence to their personal decisions in everyday life. The tendency to rely on the anecdotal experiences of a small number of people is sometimes called the *"I have a friend who" syndrome,* because no matter what the topic is, it seems that someone will provide a personal story about a friend as evidence for his or her particular point of view. In short, when you hear people support their assertions with personal stories, a little skepticism is in order.

Table 2.3 Critical Thinking Skills Discussed in This Application

Skill	Description
Recognizing the limitations of anecdotal evidence	The critical thinker is wary of anecdotal evidence, which consists of personal stories used to support one's assertions. Anecdotal evidence tends to be unrepresentative, inaccurate, and unreliable.
Using evidence-based decision making	The critical thinker understands the need to seek sound evidence to guide decisions in everyday life.

REVIEW of Key Learning Goals

2.26 Anecdotal evidence consists of personal stories about specific incidents and experiences. However, anecdotal evidence is usually based on the equivalent of a single case study, which is not an adequate sample, and there are no safeguards to reduce the distortions often found in self-report data. Many anecdotes are inaccurate, second-hand reports of others' experiences.

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CHAPTER 2 RECAP

Key Ideas

Looking for Laws: The Scientific Approach to Behavior

- The scientific approach assumes that there are laws of behavior that can be discovered through empirical research. The goals of the science of psychology include (1) the measurement and description of behavior, (2) the understanding and prediction of behavior, and (3) the application of this knowledge to the task of controlling behavior.
- By integrating apparently unrelated facts into a coherent whole, theories permit psychologists to make the leap from describing behavior to understanding behavior.
- A scientific investigation follows a systematic pattern that includes five steps: (1) formulate a testable hypothesis, (2) select the research method and design the study, (3) collect the data, (4) analyze the data and draw conclusions, and (5) report the findings. The two major advantages of the scientific approach are its clarity in communication and its relative intolerance of error.

Looking for Causes: Experimental Research

- Experimental research involves the manipulation of an independent variable to determine its effect on a dependent variable. This research is usually done by comparing experimental and control groups, which must be alike in regard to important extraneous variables.
- Experimental designs may vary. For example, sometimes an experimental group serves as its own control group. And many experiments have more than one independent variable or more than one dependent variable. In the Featured Study, Shepperd and McNulty (2002) used the experimental method to demonstrate that emotional reactions to events depend on people's expectations.
- The experiment is a powerful research method that permits conclusions about cause-effect relationships between variables. However, the experimental method is in many cases not usable for a specific problem, and many experiments tend to be artificial.

Looking for Links: Descriptive/Correlational Research

- Psychologists rely on descriptive/correlational research when they are unable to manipulate the variables they want to study. Key descriptive methods include naturalistic observation, case studies, and surveys.
- Naturalistic observation involves careful, prolonged observation of behavior in its natural setting without any intervention. Clinical research depends heavily on case studies, which involve in-depth investigations of individuals. In a survey, researchers interview participants or administer questionnaires to gather information on specific aspects of attitudes or behavior
- Descriptive/correlational research methods allow psychologists to explore issues that might not be open to experimental investigation. However, these research methods cannot demonstrate cause-effect relationships.

Looking for Conclusions: Statistics and Research

- Psychologists use descriptive statistics, such as measures of central tendency and variability, to organize and summarize their numerical data. The mean, median, and mode are widely used measures of central tendency. Variability is usually measured with the standard deviation.
- Correlations may be either positive (when two variables co-vary in the same direction) or negative (when two variables co-vary in the opposite direction). The closer a correlation is to either +1.00 or –1.00, the stronger the association. Higher correlations yield greater predictability. However, a correlation is no assurance of causation.
- Hypothesis testing involves deciding whether observed findings support the researcher's hypothesis. Findings are statistically significant only when they are unlikely to be due to chance.

Looking for Flaws: Evaluating Research

- Scientists often try to replicate research findings to double-check their validity. Sampling bias occurs when a sample is not representative of the population of interest. Placebo effects occur when subjects' expectations cause them to change their behavior in response to a fake treatment.
- Distortions in self-reports are a source of concern whenever questionnaires and personality inventories are used to collect data. Experimenter bias occurs when researchers' expectations and desires distort their observations or unintentionally influence their subjects' behavior.

Looking into the Future: The Internet and Psychological Research

- Internet-mediated research has grown in recent years because it offers access to larger and more diverse samples, as well as specialized samples, while reducing costs and saving time. However, Internet-mediated research raises its own concerns about sampling bias and uncontrolled conditions during data collection.

Looking at Ethics: Do the Ends Justify the Means?

- Research sometimes raises complex ethical issues. In psychology, the key questions concern the use of deception with human subjects and the use of harmful or painful manipulations with animal subjects. The APA has formulated ethical principles to serve as guidelines for researchers.

Reflecting on the Chapter's Themes

- The empirical nature of psychology was elucidated throughout this chapter. Empiricism involves testing hypotheses, basing conclusions on systematic observation, and taking a skeptical approach. The chapter also showed repeatedly that our experience of the world is highly subjective.

PERSONAL APPLICATION Finding and Reading Journal Articles

- Journals publish technical and scholarly material. Usually they are written for other professionals in a narrow area of inquiry. Technical journals are mostly available in academic libraries.
- PsycINFO is a computerized database that contains brief summaries of published journal articles, books, and chapters in edited books. Works on specific topics and publications by specific authors can be found by using the search mechanisms built into the database.
- Journal articles are easier to understand if one is familiar with the standard format. Most articles include six elements: abstract, introduction, method, results, discussion, and references.

CRITICAL THINKING APPLICATION The Perils of Anecdotal Evidence: "I Have a Friend Who . . ."

- Anecdotal evidence consists of personal stories about specific incidents and experiences. Anecdotes often influence people because they tend to be concrete, vivid, and memorable.
- However, anecdotal evidence is usually based on the equivalent of a single case study, which is not an adequate sample, and there are no safeguards to reduce the distortion often found in self-report data. Many anecdotes are inaccurate, second-hand reports of others' experiences. Effective critical thinking depends on evidence-based decision making.

Key Terms

Anecdotal evidence (p. 74)
Case study (p. 52)
Confounding of variables (p. 47)
Control group (p. 46)
Correlation (p. 56)
Correlation coefficient (p. 56)
Data collection techniques (p. 43)
Dependent variable (p. 46)
Descriptive statistics (p. 55)
Double-blind procedure (p. 64)
Experiment (p. 45)
Experimental group (p. 46)
Experimenter bias (p. 61)
Extraneous variables (p. 47)
Hypothesis (p. 40)
Independent variable (p. 46)
Inferential statistics (p. 58)
Internet-mediated research (p. 64)
Journal (p. 44)
Mean (p. 55)
Median (p. 55)
Mode (p. 55)
Naturalistic observation (p. 51)
Operational definition (p. 42)
Participants (p. 43)
Placebo effects (p. 60)
Population (pp. 59–60)
Random assignment (p. 47)
Reactivity (p. 52)
Replication (p. 59)
Research methods (p. 45)
Response set (p. 61)
Sample (p. 59)
Sampling bias (p. 60)
Social desirability bias (p. 61)
Standard deviation (p. 55)
Statistical significance (pp. 58–59)
Statistics (p. 55)
Subjects (p. 43)
Survey (p. 53)
Theory (p. 41)
Variability (p. 55)
Variables (p. 40)

Key People

Neal Miller (p. 68)
Robert Rosenthal (pp. 61, 64)
Stanley Schachter (pp. 45–47)

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CHAPTER 2 PRACTICE TEST

1. A tentative prediction about the relationship between two variables is:
A. a confounding of variables.
B. an operational definition.
C. a theory.
D. a hypothesis.

2. Researchers must describe the actions that will be taken to measure or control each variable in their studies. In other words, they must:
A. provide operational definitions of their variables.
B. decide if their studies will be experimental or correlational.
C. use statistics to summarize their findings.
D. decide how many subjects should participate in their studies.

3. A researcher found that clients who were randomly assigned to same-sex groups participated more in group therapy sessions than clients who were randomly assigned to coed groups. In this experiment, the independent variable was:
A. the amount of participation in the group therapy sessions.
B. whether or not the group was coed.
C. the clients' attitudes toward group therapy.
D. how much the clients' mental health improved.

4. A researcher wants to see whether a protein-enriched diet will enhance the maze-running performance of rats. One group of rats are fed the high-protein diet for the duration of the study; the other group continues to receive ordinary rat chow. In this experiment, the diet fed to the two groups of rats is the _____ variable.
A. correlated
B. control
C. dependent
D. independent

5. In a study of the effect of a new teaching technique on students' achievement test scores, an important extraneous variable would be the students':
A. hair color.
B. athletic skills.
C. IQ scores.
D. sociability.

6. Whenever you have a cold, you rest in bed, take aspirin, and drink plenty of fluids. You can't determine which remedy is most effective because of which of the following problems?
A. sampling bias
B. distorted self-report data
C. confounding of variables
D. experimenter bias

7. A psychologist monitors a group of nursery-school children, recording each instance of helping behavior as it occurs. The psychologist is using:
A. the experimental method.
B. naturalistic observation.
C. case studies.
D. the survey method.

8. Among the advantages of descriptive/correlational research is (are):
A. it allows investigators to isolate cause and effect.
B. it permits researchers to study variables that would be impossible to manipulate.
C. it can demonstrate conclusively that two variables are causally related.
D. both a and b.

9. Which of the following correlation coefficients would indicate the strongest relationship between two variables?
A. .58
B. .19
C. –.97
D. –.05

10. When psychologists say that their results are statistically significant, they mean that the results:
A. have important practical applications.
B. have important implications for scientific theory.
C. are unlikely to be due to the fluctuations of chance.
D. are all of the above.

11. Sampling bias exists when:
A. the sample is representative of the population.
B. the sample is not representative of the population.
C. two variables are confounded.
D. the effect of the independent variable can't be isolated.

12. The problem of experimenter bias can be avoided by:
A. not informing participants of the hypothesis of the experiment.
B. telling the subjects that there are no "right" or "wrong" answers.
C. using a research strategy in which neither subjects nor experimenter know which participants are in the experimental and control groups.
D. having the experimenter use only nonverbal signals when communicating with the participants.

13. Critics of deception in research have assumed that deceptive studies are harmful to participants. The empirical data on this issue suggest that:
A. many deceptive studies do produce significant distress for subjects who were not forewarned about the possibility of deception.
B. most participants in deceptive studies report that they enjoyed the experience and didn't mind being misled.
C. deceptive research seriously undermines subjects' trust in others.
D. both a and c are the case.

14. PsycINFO is:
A. a new journal that recently replaced *Psychological Abstracts*.
B. a computerized database containing abstracts of articles, chapters, and books reporting psychological research.
C. a reference book that explains the format and techniques for writing journal articles.
D. a computerized database containing information about studies that have not yet been published.

15. Anecdotal evidence:
A. is often concrete, vivid, and memorable.
B. tends to influence people.
C. is fundamentally flawed and unreliable.
D. is all of the above.

Answers
1 D p. 40
2 A p. 42
3 B p. 46
4 D p. 46
5 C p. 47
6 C p. 47
7 B pp. 51–52
8 B p. 54
9 C p. 57
10 C pp. 58–59
11 B pp. 59–60
12 C p. 64
13 B p. 66
14 B p. 71
15 D pp. 74–75

PsykTrek

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Go to the PsykTrek website or CD-ROM for further study of the concepts in this chapter. Both online and on the CD-ROM, PsykTrek includes dozens of learning modules with videos, animations, and quizzes, as well as simulations of psychological phenomena and a multimedia glossary that includes word pronunciations.

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Companion Website

www.cengage.com/psychology/weiten

Go to this site to find online resources directly linked to your book, including a glossary, flash cards, drag-and-drop exercises, quizzes, and more!

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