CHAPTER OUTLINE
1 Statistical Inferences in Decision Making
2 Types of Research in Business
3 Research Samples and Settings
4 Analyzing and Interpreting Data
5 Conducting Ethical Research
6 Thinking Critically About Research Findings
7 The Scientific Method and Health and Wellness
Statistical Inferences in Decision Making

The Thrill of Third

As officials handed out the Olympic medals for the 1,500-meter speed skating event at the 2010 Vancouver Winter Games, Jung-Su Lee of South Korea accepted the gold and Apolo Ohno of the United States took the silver. No one, though, was smiling more broadly than J. R. Celski as he accepted the bronze.

For Celski, a 19-year-old American who was recovering from an injury and had not been expected to medal at all, the thrill of third place was written all over his face. Perhaps surprisingly, the sheer joy he felt in coming in third is common.

Psychologist Tom Gilovich and his colleagues noticed this interesting phenomenon as they watched the 1992 Summer Olympic Games in Barcelona: Silver medalists generally looked noticeably less happy than the bronze medalists whom they had just beaten (Medvec, Madey, & Gilovich, 1995). The researchers surmised that these varying reactions came from the different ways in which the athletes thought about "what might have been." Silver medalists, Gilovich and his colleagues proposed, might be tortured by the thought "I almost won the gold." In contrast, bronze medalists might take solace in thinking, "I almost missed the medals altogether."

In a series of studies to investigate their theory, the researchers asked individuals who had not watched the 1992 Olympics to look at videos of the games and to rate how happy the athletes looked at two different moments—just as the events ended and as they stood on the medal podium. In support of the researchers’ hunches, the silver medalists were rated as appearing less happy than the bronze medalists both right after the event and on the podium. Moreover, in post-event interviews, the silver medalists were more likely to say how things might have gone better, while the
bronze medalists were more likely to consider how things could have been much worse.

Second place is objectively better than third, but in many ways coming in second can be a mixed blessing. Achieving third, on the other hand, is apparently "all good."

This example demonstrates how psychologists can take an observation from everyday life, develop a theory that might explain that observation, and then test their ideas systematically using the scientific method.

**PREVIEW**

Being a psychologist means being a scientist who studies psychology. In this chapter, we review the scientific method. You will read about the ways that psychologists have applied this general method to a variety of important topics and about the steps that are involved in recognizing research questions, developing methods to test them, and using statistical techniques to understand the results. Later in the chapter we consider some of the ethical issues that are involved in scientific inquiry. Psychology shares a great deal with other sciences, but as you will see, topics that psychologists study sometimes require special methodological and ethical consideration. To close the chapter, we examine the role of psychological research in health and wellness.

**1. STATISTICAL INFERENCES IN DECISION MAKING**

Science is defined not by what it investigates but by how it investigates. Whether you want to study photosynthesis, butterflies, Saturn's moons, or happiness, the way you study your question of interest determines whether your approach is scientific. The scientific method is how psychologists gain knowledge about mind and behavior.

It is the use of the scientific method that makes psychology a science (Langston, 2011; McBurney & White, 2010). Indeed, most of the studies psychologists publish in research journals follow the scientific method, which comprises these five steps (Figure 1):

1. Observing some phenomenon
2. Formulating hypotheses and predictions
3. Testing through empirical research
4. Drawing conclusions
5. Evaluating the theory

**Step 1. Observing Some Phenomenon**

The first step in conducting a scientific inquiry involves observing some phenomenon in the world. The curious, critically thinking psychologist sees something in the world and wants to know why or how it is the way it is. The phenomena that scientists study are called variables, a word related to the verb to vary. A variable is anything that can change. For example, one variable that interests psychologists is happiness. Some people seem to be generally happier than others. What might account for these differences?

As scientists consider answers to such questions, they often develop theories. A theory is a broad idea or set of closely related ideas that attempts to explain observations. Theories tell us about the relationships between variables on a conceptual level. Theories seek to explain why certain things have happened, and they can be used to make predictions.
about future observations. For instance, some psychologists theorize that the most important human need is the need to belong to a social group (Baumeister & Leary, 2000).

**Step 2. Formulating Hypotheses and Predictions**

The second step in the scientific method is stating a hypothesis. A **hypothesis** is an educated guess that derives logically from a theory. It is a prediction that can be tested. A theory can generate many hypotheses. If more and more hypotheses are related to a theory turn out to be true, the theory gains in credibility. So, a researcher who believes that social belonging is the most important aspect of human functioning might predict that people who belong to social groups will be happier than those who do not. Another hypothesis from the theory that belongingness is important to human functioning might be that individuals who have been socially excluded should feel less happy than those who have been socially included.

**Step 3. Testing Through Empirical Research**

The next step in the scientific method is to test the hypothesis by conducting **empirical research**, that is, by collecting and analyzing data. At this point, it is time to design a study that will test predictions that are based on the theory. To do so, a researcher first needs a concrete way to measure the variables of interest.

An **operational definition** provides an objective description of how a variable is going to be measured and observed in a particular study. Operational definitions eliminate the fuzziness that might creep into thinking about a problem. Imagine, for instance, that everyone in your psychology class is asked to observe a group of children and to keep track of kind behaviors. Do you think that all your classmates will define “kind behaviors” in the same way? Establishing an operational definition ensures that everyone agrees on what a variable means.
To measure personal happiness, for example, prominent psychologist Ed Diener and his students (1985) devised a self-report questionnaire that measures how satisfied a person is with his or her life, called the Satisfaction with Life Scale. (You will get a chance to complete the questionnaire later in this chapter.) Scores on this questionnaire are then used as measures of happiness. Research using this scale and others like it has shown that certain specific factors—marriage, religious faith, purpose in life, and good health—are strongly related to being happy (Diener, 1999; Pavot & Diener, 2008).

Importantly, there is not just one operational definition for any variable. While Diener and colleagues used a questionnaire, consider that in the study of silver and bronze medalists described at the beginning of this chapter, researchers used ratings of facial expressions as an operational definition of happiness. In yet another study, one that examined happiness as a predictor of important life outcomes, Lee Anne Harker and Dacher Keltner (2001) looked at the yearbook pictures of college women who had graduated three decades earlier and coded the photographs for the appearance of Duchenne smiling.

This type of smiling is genuine smiling—the kind that creates little wrinkles around the outer corner of the eyes. Duchenne smiling has been shown to be a sign of true happiness. (If you want to see whether someone in a photograph is smiling genuinely, cover the bottom of the person's face. Can you still tell that he or she is smiling? A genuine smile is evident in the eyes, not just the mouth.) So, while Diener and colleagues operationally defined happiness as a score on a questionnaire, Harker and Keltner operationally defined happiness as Duchenne smiling. Harker and Keltner found that happiness, as displayed in these yearbook pictures, predicted positive life outcomes, such as successful marriages and satisfying lives, some 30 years later.

Devising satisfactory operational definitions for the variables in a study is a crucial step in designing psychological research. To study anything, we have to have a way to see it or measure it. Clearly, in order to establish an operational definition for any variable, we first must agree on what we are trying to measure. If we think of happiness as something that people know about themselves, then a questionnaire score might be a good operational definition of the variable. If we think that people might not be aware of how happy they are (or are not), then a facial expression might be a better operational definition. In other words, our definition of a variable must be set out clearly before we operationally define it. You might try your hand at operationally defining the following variables: generosity, love, maturity, exhaustion, and physical attractiveness. What are some things that you find interesting? How might you operationally define these variables?

Because operational definitions allow for the measurement of variables, researchers have a lot of numbers to deal with once they have conducted a study. A key aspect of the process of testing hypotheses is **data analysis**. Data refers to all the information (all those numbers) researchers collect in a study—say, the questionnaire scores or the behaviors observed. Data analysis means “crunching” those numbers mathematically to see if they support predictions. We will cover some of the basics of data analysis later in this chapter.

The following example demonstrates the first three steps in the scientific method. One theory of well-being is **self-determination theory** (Deci & Ryan, 2000; Ryan & Deci, 2009). According to this theory, people are likely to feel fulfilled when their lives meet three important needs: relatedness (warm relations with others), autonomy (independence), and competence (mastering new skills). One hypothesis that follows logically from this theory is that people who value money, material possessions, prestige, and physical appearance (that is, extrinsic rewards) over the needs of relatedness, autonomy, and competence (which are intrinsic rewards) should be less fulfilled, less happy, and less well adjusted. In a series of studies entitled “The Dark Side of the American Dream,” researchers Timothy Kasser and Richard Ryan asked participants to complete self-report measures of values and of psychological and physical functioning (Kasser & Ryan, 1993, 1996; Kasser & others, 2004). Thus, the operational definitions of values and psychological functioning were questionnaire scores. The researchers found that individuals who value material rewards over more intrinsic rewards do indeed tend to suffer as predicted.
Step 4. Drawing Conclusions

Based on the results of the data analyses, scientists then draw conclusions from their research. It is important to keep in mind that usually a theory is revised only after a number of studies produce similar results. Before we change a theory, we want to be sure that the research can be replicated, or repeated, by other scientists using different methods. If a research finding is shown again and again—that is, if it is replicated—across different researchers and different specific methods, it is considered reliable. It is a result on which we can depend.

Step 5. Evaluating the Theory

The final step in the scientific method is one that never really ends. Researchers submit their work for publication, and it undergoes rigorous review. Afterward, the published studies are there for all to see, read, and evaluate continually. Scholars go back and consider the theory that started it all. Do the studies really support the theory?

One special type of study involves a meta-analysis. Meta-analysis is a statistical procedure that summarizes a large body of evidence from the research literature on a particular topic. For a meta-analysis, a researcher tries to find all of the studies that have been done on a topic of interest. The researcher then compares all the studies and their findings. A meta-analysis allows researchers to conclude whether a result is consistent in the literature and to estimate the magnitude of the relationship between variables (McDonald & others, 2010). An example of a meta-analysis is a study conducted by Sonja Lyubomirsky and her colleagues examining the relationship between happiness and work success (Lyubomirsky, King, & Diener, 2005). They found that across 43 different studies, happy people were less likely to be “burned out” and to think about quitting their jobs and more likely to receive positive evaluations from their supervisors.

The research community maintains an active conversation about what scientists know, and this dialogue constantly questions conclusions. From published studies, a scholar may come up with a new idea that will eventually change the thinking on some topic. Steps 3, 4, and 5 in the scientific method are part of an ongoing process. That is, researchers go back and do more research, revise their theories, hone their methods, and draw and evaluate their new conclusions.

2: TYPES OF RESEARCH IN BUSINESS

Psychologists commonly use three types of research. Descriptive research involves finding out about the basic dimensions of some variable (for example, what the average level of happiness is for men in the United States). Correlational research is interested in discovering relationships between variables (for instance, whether being married predicts greater happiness for men). Experimental research concerns establishing causal relationships between variables (for example, whether women perceive men as more attractive if the men are smiling). In this section, we examine each of these types of research.

Descriptive Research

Just as its name suggests, descriptive research is about describing some phenomenon—determining its basic dimensions and defining what this thing is, how often it occurs, and so on. By itself, descriptive research cannot prove what causes some phenomenon, but it can reveal important information about people’s behaviors and attitudes (Stake, 2010). Descriptive research methods include observation, surveys, and interviews, and case studies.

Observation

Imagine that you are going to conduct a study on how children who are playing together resolve conflicts that arise. The data that are of interest to you concern conflict resolution.
As a first step, you might go to a playground and simply observe what the children do—how often you see conflict resolution occur and how it unfolds. You would likely keep careful notes of what you observe.

This type of scientific observation requires an important set of skills (R. A. Smith & Davis, 2010). Unless you are a trained observer and practice your skills regularly, you might not know what to look for, you might not remember what you saw, you might not realize that what you are looking for is changing from one moment to the next, and you might not document and communicate your observations effectively. Furthermore, you might not realize the value of having one or more others do the observations as well, so that you develop a sense of the accuracy of your observations. In short, for observations to be effective, they must be systematic. You must know whom you are observing, when and where you will observe, and how you will make the observations. Also, you need to know in advance in what form you will document them: in writing, by sound recording, or by video.

**SURVEYS AND INTERVIEWS**

Sometimes the best and quickest way to get information about people is to ask them for it. One technique is to interview them directly. A related method that is especially useful when information from many people is needed is the survey, or questionnaire. A survey presents a standard set of questions, or items, to obtain people’s self-reported attitudes or beliefs about a particular topic.

Although surveys can be a straightforward way to measure psychological variables, constructing them requires care (Stangor, 2011). For example, surveys can measure only what people think about themselves. Thus, if we are interested in studying a variable that we think is unconscious, such as a psychodynamic drive, we cannot use a survey. Furthermore, people do not always know the truth about themselves. If you were answering a survey that asked, “Are you a generous person?” how might your answer compare to that of a friend who is asked to make that same rating about you? One particular problem with surveys and interviews is the tendency of participants to answer questions in a way that will make them look good rather than in a way that communicates what they truly think or feel (McMillan & Wergin, 2010).

Another challenge in survey construction is that when a questionnaire is used to define variables operationally, it is crucial that the items clearly probe the specific topic of interest and not some other characteristic. The language used in a survey therefore must be clear and understandable if the responses are to reflect the participants’ actual feelings.

Surveys and interviews can examine a wide range of topics, from religious beliefs to sexual habits to attitudes about gun control (Rosnow & Rosenthal, 2008). Some survey and interview questions are unstructured and open-ended, such as “How fulfilling would you say your marriage is?” Such questions allow for unique responses from each person surveyed. Other survey and interview questions are more structured and ask about quite specific things. For example, a structured question might ask, “How many times have you talked with your partner about a personal problem in the past month? 0, 1–2, 3–5, 6–10, 11–30, every day?”

**CASE STUDIES**

A case study, or case history, is an in-depth look at a single individual. Case studies are performed mainly by clinical psychologists when, for either practical or ethical reasons, the unique aspects of an individual’s life cannot be duplicated and tested in other individuals. A case study provides information about one person’s goals, hopes, fantasies, fears, traumatic experiences, family relationships, health, and anything else that helps the psychologist understand the person’s mind and behavior. Case studies can also involve in-depth explorations of particular families or social groups.

An example of a case study is the analysis of India’s spiritual leader Mahatma Gandhi (1869–1948) by psychodynamic theorist Erik Erikson (1969). Erikson studied Gandhi’s life in great depth to discover how his positive spiritual identity developed, especially...
during his youth. In piecing together Gandhi's identity development, Erikson described the contributions of culture, history, family, and various other factors that might affect the way other people form an identity.

Case histories provide dramatic, detailed portrayals of people's lives, but we must be cautious about applying what we learn from one person's life to other people. The subject of a case study is unique, with a genetic makeup and personal history that no one else shares. Case studies can be very valuable at the first step of the scientific method, in that they often provide vivid observations that can then be tested in a variety of ways in psychological research. However, and importantly, an in-depth study of a single case may not be generalizable to the general population.

**THE VALUE OF DESCRIPTIVE RESEARCH**

Descriptive research allows researchers to get a sense of a subject of interest, but it cannot answer questions about how and why things are the way they are. Nevertheless, descriptive research does explore intriguing topics, such as the experience of happiness in different cultures. Before reading about and considering the value of that research, complete the measure below. Specifically, using the 7-point scale, indicate your agreement with each item that follows the scale.

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<td>Disagree</td>
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1. In most ways my life is close to my ideal.
2. The conditions of my life are excellent.
3. I am satisfied with my life.
4. So far I have gotten the important things I want in life.
5. If I could live my life over, I would change almost nothing.

You have just completed the Satisfaction with Life Scale (or SWLS; Diener & others, 1985), one operational definition of happiness. To find out your score, add up your ratings and divide by 5. This average rating could be considered your level of general happiness. A broad range of studies in many different countries have used this scale and others like it to measure happiness levels. Based on such research, Ed and Carol Diener (1996) concluded that most people are pretty happy because they score above the midpoint, 3.5, on the scale you just completed. However, research on happiness in various cultures has generally centered on relatively industrialized countries. What about non-industrialized societies?

One study examined levels of happiness in groups of people who have not generally been included in psychological studies (Biswas-Diener, Vitterso, & Diener, 2005). The research examined three groups: the Inughuits (Inuits) of Greenland, the Maasai of southern Kenya, and American Old Order Amish. All three groups completed measures essentially the same as the one you just did.

The Inuit tribe studied (the Inughuits) live at 79 degrees latitude (very far north), in the harshest climate inhabited by a traditional human society. Rocks, glaciers, and the sea dominate the landscape. Farming is impossible. The Inughuits have some modern conveniences, but they generally adhere to a traditional hunting culture. It is not uncommon to find an Inughuit hunter carving a seal or caribou on the kitchen floor while children watch TV in the next room. Most of us might feel a little blue in the winter months when gloomy weather seems to stretch on, day after day. For the Inughuits, however, the sun never rises at all throughout the winter months, and in the summer, it never sets. How happy could an individual be in such a difficult setting? Pretty happy, it turns out, as the Inughuits averaged a 5.0 on the Satisfaction with Life Scale.

The Maasai are an indigenous (native) African nomadic group who live in villages of about 20 people, with little exposure to the West. Maasai are fierce warriors, and their culture has many traditional ceremonies built around a boy's passage from childhood to manhood. Boys are circumcised between the ages of 15 and 22, and they are
forbidden from moving or making a sound during the procedure. Girls also experience circumcision as they enter puberty, in a controversial rite that involves the removal of the clitoris and that makes childbirth extremely difficult. The Maasai practice child marriage and polygamy. Maasai women have very little power and are generally expected to do most of the work. How happy could an individual be in this context? Maasai men and women who completed the measure orally in their native tongue, Maa, averaged a 5.4 on the life satisfaction scale (Biswas-Diener, Vitteros, & Diener, 2005).

Finally, the Old Order Amish of the midwestern and northeastern United States belong to a strict religious sect that explicitly rejects modern aspects of life. The Amish separate themselves from mainstream society and travel by horse and buggy. The women wear bonnets, and the men sport beards, dark clothes, and dark brimmed hats. The Amish farm without modern machinery and dedicate their lives to simplicity—without radios, TVs, CDs, DVDs, iPods, cell phones, washing machines, and cars. Still, the Amish are relatively happy, averaging 4.4 on the 7-point happiness scale (Biswas-Diener, Vitteros, & Diener, 2005).

Like a host of other studies in industrialized nations, these results indicate that most individuals are pretty happy. Such descriptive findings provide researchers of well-being a valuable foundation for further examining the processes that lead to these feelings of happiness in different cultural settings. If a researcher wanted to extend these findings to investigate predictors of happiness in different cultures, he or she would then turn to a correlational design.

**LONGITUDINAL DESIGNS**

One way that correlational researchers can deal with the issue of causation is to employ a special kind of systematic observation called a **longitudinal design**. Longitudinal research involves obtaining measures of the variables of interest in multiple waves over time. This type of research can suggest potential causal relationships because if one variable is thought to cause changes in another, it should be detectable in the data over time.

One intriguing longitudinal study is the Nun Study, conducted by David Snowdon and his colleagues (Grossi & others, 2007; Mortimer, Snowdon, & Markesbery, 2009; Snowdon, 2003). The study began in 1986 and has followed a sample of 678 School Sisters of Notre Dame (SSND) ever since. The nuns ranged in age from 75 to 103 when the study began. These women complete a variety of psychological and physical measures annually. This sample is unique in many respects. However, certain characteristics render the participants an excellent group for correlational research. For one thing, many potential extraneous third variables are relatively identical for all the women in the group. Specifically, their biological sex, living conditions, diet, activity levels, marital status, and religious participation are essentially held constant, so there is little chance that differences would arise in these variables that might explain the study’s results.

Researchers examined the relationship between happiness and longevity using this rich dataset. All of the nuns had been asked to write a spiritual autobiography when they entered the convent (for some, as many as 80 years before). Deborah Danner and her colleagues (2001) were given access to these documents and used them as indicators of happiness earlier in life by counting the number of positive emotions expressed in the autobiographies (note that here we have yet another operational definition of happiness). Higher levels of positive emotion expressed in autobiographies written at an average age of 22 were associated with a 2.5-fold difference in risk of mortality when the nuns were in their 80s and 90s. That is, women who included positive emotion in their autobiographies when they were in their early 20s were two-and-a-half times more likely to survive some 60 years later.

Longitudinal designs provide ways by which correlational researchers may attempt to demonstrate causal relations among variables (Gibbons, Hedeker, & DuToit, 2010). Still, it is important to be aware that even in longitudinal studies, causal relationships are not completely clear. For example, the nuns who wrote happier autobiographies may...
Miserable but Helpful?

Many studies have shown that happy individuals are more helpful than people in a negative mood. Social psychologist R. F. Soames Job (1987) was interested in examining how mood relates to helping. In a clever study, he used naturally occurring mood and an unusual measure of helpfulness.

The study took place outside a major rugby match pitting Canterbury-Bankstown against St. George, in Sydney, Australia. Rugby is enormously popular in Sydney, and more than 40,000 people attended the match. While the game was going on, the researchers placed 100 stamped letters on the windshields of cars parked around the sporting grounds. The letters were addressed to the same person, and a handwritten note on each letter said, "Found near your car." Cars belonging to supporters of each team were identified by different colored streamers, team stickers, and posters. Fifty letters were placed on the cars of supporters of each team. The researchers then waited to see which type of fan was most likely to put the letter in the mailbox—a fan of the winning team or of the losing team. The figure shows the results. Try your hand at the questions below.

1. What were the variables of interest in this study?
2. How did the study operationally define these variables?
3. Why is this a correlational study?
4. Did the researchers conclude that these data support the notion that negative mood relates to helping? Is this conclusion justified, in your opinion? Why or why not?
5. Identify at least one third variable that might explain the results of this study.

have had happier childhood experiences that might be influencing their longevity, or a particular genetic factor might explain both their happiness and their survival. As you read about correlational research studies throughout this book, do so critically, and with a modicum of skepticism; consider that even the brightest scientist may not have thought of all of the potential third variables that could have explained the results. It is easy to assume causality when two events or characteristics are merely correlated. Remember those innocent ice cream cones, and critically evaluate conclusions that may be drawn from simple observation.

Experimental Research

To determine whether a causal relationship exists between variables, researchers must use experimental methods (Christensen, Johnson, & Turner, 2011). An **true experiment** is a carefully regulated procedure in which the researcher manipulates one or more variables that are believed to influence some other variable. Imagine, for example, that a researcher notices that people who listen to classical music seem to be of above average intelligence. A correlational study on this question would not tell us if listening to classical music causes increases in intelligence. In order to demonstrate causation, the researcher would manipulate whether or not people listen to classical music. He or she might create two groups: one that listens to classical music and one that listens to pop music. To test for differences in intelligence, the researcher would then measure intelligence.
true experiment A carefully regulated research design in which the researcher manipulates an independent variable holding other variables constant (eliminating confounding variables) and measures the effects of the manipulation on the dependent variable. A crucial characteristic is the random assignment of participants to the different levels of the independent variable. Only true experiments can provide evidence for cause-and-effect relationships.

quasi-experiment A research design that resembles a true experiment but lacks the control of a true experiment, most notably lacks random assignment, and is more vulnerable to bias due to confounding variables. Therefore it cannot provide evidence for a cause-and-effect relationship.

random assignment Researchers’ assignment of participants to groups by chance, to reduce the likelihood that an experiment’s results will be due to preexisting differences between groups.

cause-and-effect A cause is the reason that a specific thing happens, and establishing a cause-and-effect relationship requires that all other possible reasons be eliminated. Evidence for a cause-and-effect relationship requires the manipulation of the one variable of interest while holding all other variables constant to eliminate all of the other possible confounding reasons. A true experiment which includes random assignment of subjects to each level of the independent variable eliminates confounding variables and allows us to establish causality. Quasi-experiments do not eliminate all confounding variables and therefore may not be used as evidence of a cause-and-effect relationship.

independent variable A manipulated experiential factor; the variable that the experimenter changes to see what its effects are.

confounding variable A variable that is not controlled for in a study and varies systematically with the different levels of the independent variable making it impossible to know the reason or cause of the effect on the dependent variable. Quasi-experiments are more likely to have confounding variables than true experiments are, which is why they cannot provide the strongest evidence for cause-and-effect.

confederate A person who is given a role to play in a study so that the social context can be manipulated.

dependent variable The outcome; the factor that can change in an experiment in response to changes in the independent variable.

If that manipulation led to differences between the two groups on intelligence, we could say that the manipulated variable caused those differences: The experiment has demonstrated cause and effect. This notion that experiments can demonstrate causation is based on the idea that if participants are randomly assigned to groups, the only systematic difference between them must be the manipulated variable. Random assignment means that researchers assign participants to groups by chance. This technique reduces the likelihood that the experiment’s results will be due to any preexisting differences between groups (Graziano & Raulin, 2010).

To get a sense of what experimental studies, as compared to correlational studies, can reveal, consider the following example. Psychologists have long assumed that experiencing one’s life as meaningful is an important aspect of psychological well-being (Frankl, 1963/1984; Steger & Frazier, 2005). Because surveys that measure meaning in life and well-being correlate positively (that is, the more meaningful your life, the happier you are), the assumption has been that experiencing meaning in life causes greater happiness. Because the studies involved in exploring this relationship have been correlational, however, the cause is unclear. Meaning in life may lead people to be happier, but the reverse might also be true: Happiness might make people feel that their lives are more meaningful.

To address this issue, Laura King and her colleagues conducted a series of laboratory experiments (King & Hicks, 2010; King & others, 2006). In one study, the researchers put some participants in a positive mood by having them listen to happy music. Other participants listened to neutral music. Participants who listened to happy music rated their lives as more meaningful than did individuals who listened to neutral music. Note that participants were randomly assigned to one of two conditions, happy music or neutral music, and then rated their meaning in life using a questionnaire. In this case happiness was operationally defined by the type of music participants heard, and meaning in life was operationally defined by ratings on a questionnaire. Because participants were randomly assigned to conditions, we can assume that the only systematic difference between the two groups was the type of music they heard. As a result, we can say that the happy music caused people to rate their lives as more meaningful.

INDEPENDENT AND DEPENDENT VARIABLES

Experiments have two types of variables: independent and dependent. An independent variable is a manipulated experimental factor. The independent variable is the variable that the experimenter changes to see what its effects are; it is a potential cause. Any experiment may include several independent variables, or factors, that are manipulated, to determine their effect on some outcome. In the study of positive mood and meaning in life, the independent variable is mood (positive versus neutral), operationally defined by the type of music participants heard.

Sometimes the independent variable is the individual’s social context. Social psychologists often manipulate the social context with the help of a confederate. A confederate is a person who is given a role to play in a study so that the social context can be manipulated. For example, if a researcher is interested in reactions to being treated rudely, he or she might assign a confederate to treat participants rudely (or not).

A dependent variable in an experiment is the variable that may change as a result of manipulations of the independent variable. It represents the outcome (effect) in an experiment. As researchers manipulate the independent variable, they measure the dependent variable to test for any effect of the manipulated variable. In the study by King and others of music type and meaning in life, meaning in life was the dependent variable.

Independent and dependent variables are two of the most important concepts in psychological research. Remember that the independent variable is the cause, and the dependent variable is the effect.
**EXPERIMENTAL AND CONTROL GROUPS**

Experiments can involve one or more experimental groups and one or more control groups. In an experiment, the researcher manipulates the independent variable to create these groups. An experimental group consists of the participants in an experiment who receive, say, the drug or other treatment under study—that is, those who are exposed to the change that the independent variable represents. A control group in an experiment is as much like the experimental group as possible and is treated in every way like the experimental group except for that change. The control group provides a comparison against which the researcher can test the effects of the independent variable. In the study of meaning in life, participants who listened to happy music were the experimental group, and those who heard neutral music were the control group.

To see how experimental and correlational research can be applied to the same research question, check out the Intersection.

**SOME CAUTIONS ABOUT EXPERIMENTAL RESEARCH**

**Validity** refers to the soundness of the conclusions that a researcher draws from an experiment. Two broad types of validity matter to experimental designs. The first is **external validity**, which refers to the degree to which an experimental design actually reflects the real-world issues it is supposed to address. That is, external validity is concerned with the question, do the experimental methods and the results generalize—do they apply—to the real world?

Imagine, for example, that a researcher is interested in the influence of stress (the independent variable) on creative problem solving (the dependent variable). The researcher randomly assigns individuals to be blasted with loud noises at random times during the session (the high-stress or experimental group) or to complete the task in relative quiet (the control group). At the task, the researcher gives all participants a chance to be creative by asking them to list every use they can think of for a cardboard box. Counting up the number of uses that people list, the researcher discovers that those in the high-stress group generated fewer uses of the box. This finding might seem to indicate that stress reduces creativity. In considering the external validity of this study, however, we might appropriately ask some questions: How similar are the blasts of loud, random noises to the stresses people experience every day? Is listing uses for a cardboard box really an indicator of creativity? We are asking, in other words, if these operational definitions do a good job of reflecting the real-world processes they are supposed to represent.

The second type of validity is **internal validity**, which refers to the degree to which changes in the dependent variable are genuinely due to the manipulation of the independent variable. In the case of internal validity, we want to know whether the experimental methods are free from biases and logical errors that may render the results suspect. Although experimental research is a powerful tool, it requires safeguards (Leary, 2008). Expectations and biases can, and sometimes do, tarnish results (Ray, 2009; Rosnow & Rosenthal, 2008), as we next consider.

**Experimenter Bias** Experimenter bias may subtly (and often unknowingly) influence their research participants. Experimenter bias occurs when the experimenter's expectations influence the outcome of the research. No one designs an experiment without wanting meaningful results. Consequently, experimenters can sometimes subtly communicate to participants what they want the participants to do. **Demand characteristics** are any aspects of a study that communicate to participants how the experimenter wants them to behave. The influence of experimenter expectations can be very difficult to avoid.

In a classic study, Robert Rosenthal (1966) turned college students into experimenters. He randomly assigned the participants rats from the same litter. Half of the students were told that their rats were "maze bright," whereas the other half were told that their
Social Psychology and Developmental Psychology: 
Is High Self-Esteem Such a Good Thing?

Low self-esteem is frequently implicated in society's ills, 
from juvenile delinquency to violent acts of aggression. It 
often seems as if we could make the world a better place if we 
could help everyone achieve higher self-esteem. Yet in the 
late 1990s, psychologist Roy Baumeister presented a provoca-
tive idea: He suggested that high self-esteem, not low self-
estee, is associated with aggressive acts (Baumeister, 1999; 
Baumeister, Bushman, & Campbell, 2000; Baumeister & Butz, 
2005; Baumeister & others, 2007; Bushman & Baumeister, 
2002). In a variety of experimental studies, he showed that in-
dividuals who scored very high on a measure of self-esteem 
were more likely than their counterparts with low self-esteem 
to behave aggressively toward others when their self-esteem 
was threatened. For example, individuals with high self-esteem might have been more 
likely to blast someone with loud noise in 
the lab after being told that they did not 
perform well on an intelligence test. These find-
ings conflicted with a 
long-held belief in psy-
chology that self-esteem was a central component of psycho-
logical health.

Following the publication of Baumeister's work, research 
conducted by developmental psychologists (who study the ways 
human beings mature from earliest childhood to old age) chal-
 lenged the notion that high self-esteem was bad. These research-
ers used longitudinal data collected from a large sample of 
individuals in Dunedin, New Zealand, to show that contrary to 
Baumeister's conclusions, low (not high) self-esteem was associ-
 ated with a variety of negative outcomes, including aggression, 
delinquency, poor health, 
and limited economic pros-
ts through the middle 
adulthood years (Donnellan 
& others, 2005; Trzesniewski 
& others, 2006).

How can we resolve this 
apparent conflict between 
experimental evidence and 
longitudinal correlational 
evidence? One possibility is 
that individuals with high 
self-esteem might act aggressively in the artificial setting of a 
lab and would not engage in actual aggressive behavior in real life. Another possibility is 
that Baumeister was talking about a particular kind of high self-esteem: inflated and unstable high self-esteem (W. K. Campbell 
& others, 2004; Konrath, Bushman, & Campbell, 2006). Individuals with unrealistically high self-esteem appear to be prone to react aggressively in response to a threat. Such individuals might be best described not as psychologically healthy but rather as 
narcissistic. For most people, though, it is more likely that low 
self-esteem rather than high self-esteem is linked to higher 
levels of aggression.

Do you know anyone who is 
aggressive? Do you think the person has high or low 
self-esteem?

rats were "maze dull." The students then conducted experiments to test their rats' ability to navigate mazes. The results were stunning. The so-called maze-bright rats were more 
successful than the maze-dull rats at running the mazes. The only explanation for 
the results is that the college students' expectations, conveyed in their behaviors, affected 
the rats' performance.

Often the participants in psychological studies are not rats but people. Imagine that 
you are an experimenter, and you know that a participant is going to be exposed to 
disturbing pictures in a study. Is it possible that you might treat the person differently 
than you would if you were about to show him photos of cute kittens? The reason 
experimenter bias is important is that it introduces systematic differences between the 
experimental group and the control groups; this means that we cannot know if those 
who looked at disgusting pictures were more, say, upset because of the pictures or 
because of different treatment by the experimenter.
Like third variables in correlational research, these systematic biases are called confounds. In experimental research, confounds are factors that “ride along” with the experimental manipulation, systematically and undesirably influencing the dependent variable. Experimenter bias, demand characteristics, and confounds may all lead to biased results.

**Research Participant Bias and the Placebo Effect**  Like experimenters, research participants may have expectations about what they are supposed to do and how they should behave, and these expectations may affect the results of experiments (Christensen, 2007). Research participant bias occurs when the behavior of research participants during the experiment is influenced by how they think they are supposed to behave or by what their expectations are about what is happening to them.

One example of the power of participant expectations is the placebo effect. The **placebo effect** occurs when participants' expectations, rather than the experimental treatment, produce a particular outcome. Participants in a drug study might be assigned to an experimental group that receives a pill containing an actual painkiller or to a control group that receives a placebo pill. A placebo is a harmless substance that has no physiological effect. This placebo is given to participants in a control group so that they are treated identically to the experimental group except for the active agent—in this case, the painkiller. Giving individuals in the control group a placebo pill allows researchers to determine whether changes in the experimental group are due to the active drug agent and not simply to participants' expectations.

Another way to ensure that neither the experimenter's nor the participants' expectations affect the outcome is to design a **double-blind experiment**. In this design, neither the experimenter administering the treatment nor the participants are aware of which participants are in the experimental group and which are in the control group until the results are calculated. This setup ensures that the experimenter cannot, for example, make subtle gestures signaling who is receiving a drug and who is not. A double-blind study allows researchers to distinguish the specific effects of the independent variable from the possible effects of the experimenter's and the participants' expectations about it.

Advertisements for prescription drugs usually describe not only the side effects on people taking the actual drug but also the effects experienced by individuals receiving a placebo.
Applications of the Three Types of Research

All three types of research—descriptive, correlational, and experimental—can be used to address the same topic (Figure 2). For instance, various researchers have used different research methods to explore the role of intensely positive experiences in human functioning, as follows.

Abraham Maslow believed that people who were the healthiest and the happiest were capable of having intense moments of awe; he used the descriptive case study approach (1971) to examine the role of such “peak experiences” in the lives of such individuals, who seemed to enjoy the best of life. In contrast, Dan McAdams (2001) used correlational research to probe individuals’ descriptions of their most powerful positive experiences. He found that individuals who were motivated toward warm interpersonal experiences tended to mention such experiences as the best memories of their lives. Finally, experimental researchers have also investigated this topic by randomly assigning
individuals to write about their most intensely positive experiences for a few minutes each day for two or three days. Those who wrote about emotional and happy topics experienced enhanced positive mood as well as fewer physical illnesses two months later, as compared to individuals in control groups who wrote about topics that were not emotional (Burton & King, 2004; 2008). So, researchers coming from many different methodological perspectives can address the same topic, leading to different but valuable contributions to knowledge.

3. RESEARCH SAMPLES AND SETTINGS

Regardless of whether a study is correlational or experimental, among the important decisions to be made about collecting data are whom to choose as the participants and where to conduct the research. Will the participants be people or animals? Will they be children, adults, or both? Where will the research take place—in a lab or in a natural setting?

The Research Sample

When psychologists conduct a study, they usually want to be able to draw conclusions that will apply to a larger group of people than the participants they actually study. The entire group about which the investigator wants to draw conclusions is the population. The subset of the population chosen by the investigator for study is a sample. The researcher might be interested only in a particular group, such as all children who are gifted and talented, all young women who embark on science and math careers, or all gay men. The key is that the sample studied must be representative of the population to which the investigator wants to generalize his or her results. That is, the researcher might study only 100 gifted adolescents, but if she wants to apply these results to all gifted and talented adolescents. A representative sample for the United States would reflect the U.S. population's age, socioeconomic status, ethnic origins, marital status, geographic location, religion, and so forth.

To mirror the population as closely as possible, the researcher uses a random sample, a sample that gives every member of the population an equal chance of being selected. Random sampling improves the chances that the sample is representative of the population. In actual practice, however, random sampling typically only approximates this

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test yourself

1. Define descriptive, correlational, and experimental research.
2. Explain why correlation is not the same as causation.
3. What is the difference between an experimental group and a control group?

- population The entire group about which the investigator wants to draw conclusions.
- sample The subset of the population chosen by the investigator for study.
- random sample A sample that gives every member of the population an equal chance of being selected.

The research sample might include a particular group, such as all gay men or all women runners.
ideal—for example, by randomly sampling people who have telephones or people who live in a particular town or state. Note that a random sample is not the same thing as random assignment. Random assignment is about making sure experimental and control groups are equivalent, and a random sample is about selecting participants from a population so that the sample is representative of that population.

In selecting a sample, researchers must strive to minimize bias, including gender bias. Because psychology is the scientific study of human behavior, it should pertain to all humans, and so the participants in psychological studies ought to be representative of humanity as a whole. Early research in the field often included just the male experience—not only because the researchers themselves were often male, but also because the participants too were typically male (Etauqg & Bridges, 2010). For a long time, the human experience studied by psychologists was primarily the male experience.

There is also a growing realization that psychological research needs to include more people from diverse ethnic groups (Swanson, Edwards, & Spencer, 2010; Tamis-LeMonda & McFadden, 2010). Because a great deal of psychological research involves college student participants, individuals from groups that have not had as many educational opportunities have not been strongly represented in that research. Given the fact that individuals from diverse ethnic groups have been excluded from psychological research for so long, we might reasonably conclude that people's real lives are more varied than past research data have indicated.

These issues are important because scientists want to be able to predict human behavior broadly speaking, not just the behavior of non-Latino White, male college students. Imagine if policymakers planned their initiatives for a wide range of Americans based on research derived from only a small group of individuals from a particular background. What might the results be?

The Research Setting

All three types of research we examined in the preceding section can take place in different physical settings. The setting of the research does not determine the type of research it is. Common settings include the research laboratory and natural settings.

Natural settings and laboratories are common locales for psychological studies. (Left) Jane Goodall, who specializes in animal behavior, has carried out extensive research on chimpanzees in natural settings. Her work has contributed a great deal to our understanding of these intelligent primates. (Right) Barbara L. Fredrickson, a psychologist at the University of North Carolina, Chapel Hill, whose work investigates topics such as positive emotions and human flourishing, conducts a laboratory study.
Because psychological researchers often want to control as many aspects of the situation as possible, they conduct much of their research in a laboratory—a controlled setting with many of the complex factors of the real world, including potential confounds, removed (Kantowitz, Roediger, & Elmes, 2009). Although laboratory research provides a great deal of control, doing research in the laboratory has drawbacks. First, it is almost impossible to conduct research in the lab without the participants knowing they are being studied. Second, the laboratory setting is not the real world and therefore can cause the participants to behave unnaturally. A third drawback of laboratory research is that individuals who are willing to go to a university laboratory may not be representative of groups from diverse cultural backgrounds. Those who are unfamiliar with university settings and with the idea of "helping science" may be intimidated by the setting. Fourth, some aspects of the mind and behavior are difficult if not impossible to examine in the laboratory.

Research can also take place in a natural setting. Naturalistic observation is viewing behavior in a real-world setting (Leedy & Ormrod, 2010). Psychologists conduct naturalistic observations at sporting events, child-care centers, work settings, shopping malls, and other places that people frequent. If you wanted to study the level of civility on your campus for a research project, most likely you would include naturalistic observation of how people treat one another in such gathering places as the cafeteria and the library reading room. In another example of a natural setting, researchers who use survey methods are increasingly relying on web-based assessments that allow participants to complete the measures using the Internet.

The type of research a psychologist conducts, the operational definitions of the variables of interest, and the choice of sample and setting are decisions that ideally are guided by the research question itself. However, sometimes these decisions represent a compromise between the psychologist's key objective (for example, to study a representative sample of Americans) and the available resources (for instance, a sample of 100 college students). For a closer look at the process of conducting an experiment in a real-world setting, check out the Psychological Inquiry on p. 580.

4. ANALYZING AND INTERPRETING DATA

Once psychologists collect data, whether they do so in a lab or a natural setting, it is time to analyze and interpret them. For this task they use statistics, mathematical methods for reporting data (Howell, 2010). There are two basic categories of statistics: descriptive statistics, which are used to describe and summarize data, and inferential statistics, which are used to draw conclusions about those data.

Psychology students are sometimes surprised to learn that a statistics course is often a requirement for the major. In this section, as we look at how psychologists analyze and interpret research data, you will get a flavor of the ways in which math plays an important role in the science of psychology.

Descriptive Statistics

Most psychological studies generate considerable numerical data. Simply listing all of the scores (or other measures) generated by a study—for each individual in the study—is not very meaningful. Descriptive statistics are the mathematical procedures researchers have developed to describe and summarize sets of data in a meaningful way. Descriptive statistics reveal the "big picture"—the overall characteristics of the data and the variation among them.

MEASURES OF CENTRAL TENDENCY

A measure of central tendency is a single number that indicates the overall characteristics of a set of data. The three measures of central tendency are the mean, the median, and the mode.
Experimentation in a Natural Setting

A team of social psychologists was interested in examining how mood influences helping behavior in the real world. They hypothesized that, especially among the less experienced members of a sales staff, mood would guide behavior, so that happy salespersons would be most helpful to customers and unhappy salespersons less so. Researchers Joseph Forgas, Elizabeth Dunn, and Stacey Granland (2008) conducted an experiment in a Target department store, as follows.

First, the experimenters trained two confederates. The first confederate was in charge of manipulating the employees' mood. There were three mood conditions:

- In the positive mood condition, the confederate said, "I just wanted to let someone know that I am so impressed with the service at this store! The store looks great and the staff is so nice. I was able to get what I wanted and will be coming back to this store again."

- In the negative mood condition, the confederate said, "I just wanted to let someone know that I am so disappointed with the service at this store. The store looks terrible and the staff is rude. I couldn't get anything I wanted and won't be coming back here again."

- In the neutral mood condition, the confederate simply observed, "Interesting, I have been coming here quite regularly and this store seems always the same, nothing much changes."

Employees were chosen randomly by the confederate and were randomly assigned to the conditions.

Then, after the first confederate left the employees, the second confederate, who was blind to the mood procedure (meaning unaware of the mood condition for each participant), approached the employees individually and asked, "Excuse me, could you tell me where I could find the book The White Bear?" This confederate surreptitiously recorded (1) the number of helpful responses, (2) the number of actual attempts to help, and (3) the time spent helping. These three values were averaged to create an overall helpfulness score. (If the staff salesperson saw the confederate jotting things down, the confederate pretended to be checking a shopping list.) The figure shows the results for the less experienced sales staff.

Answer these questions to see how much you remember about experimental design.

1. Despite the natural setting, this was an experiment. Why?
2. What was the independent variable and what was its operational definition?
3. What was the dependent variable and what was its operational definition?
4. Why is it important that the second confederate was "blind" to the mood condition?
5. Why were the employees assigned to mood condition randomly?
6. The store management was aware of the study, but the employees were not. Do you think the experiment was ethical? Why or why not?
Most quantitative techniques in psychological science begin with the mean. The mean is what people often call the average. The mean is calculated by adding all the scores in a set of scores and then dividing by the number of scores. As a good indicator of the central tendency for a group of scores, the mean is the measure that is used most often. When your instructor provides students with their exam grades, he or she might mention the test mean, because this average gives the class a general idea of how the group performed.

The mean is not so helpful, however, when a group of scores contains a few extreme scores, especially if the number of cases in the group is small. Consider the annual earnings for the two groups of five people shown in the table below.

<table>
<thead>
<tr>
<th>Group 1</th>
<th>Group 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>$19,000</td>
<td>$19,000</td>
</tr>
<tr>
<td>19,000</td>
<td>19,000</td>
</tr>
<tr>
<td>23,000</td>
<td>23,000</td>
</tr>
<tr>
<td>24,000</td>
<td>24,000</td>
</tr>
<tr>
<td>25,000</td>
<td>45,000,000</td>
</tr>
<tr>
<td>Mean $22,000</td>
<td>Mean $9,017,000</td>
</tr>
<tr>
<td>Median $23,000</td>
<td>Median $23,000</td>
</tr>
<tr>
<td>Mode $19,000</td>
<td>Mode $19,000</td>
</tr>
</tbody>
</table>

Group 1 lists the earnings of five ordinary people. Group 2 is composed of the earnings of four ordinary people plus the approximate earnings of movie director Steven Spielberg. Now look at the means that have been calculated for the two groups. The vast difference between them is due to the one extreme score. In such a situation, one of the other two measures of central tendency, the median or the mode, would give a more accurate picture of the data overall.

The median is the score that falls exactly in the middle of the distribution of scores after they have been arranged (or ranked) from highest to lowest. When you have an odd number of scores (say, five or seven), the median is the score with the same number of scores above it as below it. In the table above, each group has a median income of $23,000. Notice that, unlike the mean, the median is unaffected by extreme scores. The medians are the same for both groups ($23,000), but their means are extremely different ($22,000 versus $9,017,000). Of course, if there is an even number of scores, there is no "middle" score. This problem is dealt with by averaging the scores that share the middle location.

The mode is the score that occurs most often in a dataset. In our earnings example, the mode is $19,000, which occurs twice in each group. All of the other annual incomes occur only once. The mode is the least used measure of central tendency. Yet the mode can be particularly useful, for example, in cases in which information is desired about preference or popularity. Consider a teacher who wants to know the most popular or least popular child in her classroom. She might create a questionnaire and ask students which of their classmates they like the most or the least. The most frequently nominated child would be the mode in these instances.

**MEASURES OF DISPERSION**

In addition to revealing the central characteristics of a sample, descriptive statistics can also give us measures of dispersion, which describe how much the scores in a sample differ from one another. That is, these measures give us a sense of the spread of scores, or how much variability exists in the data. Let's look at some common ways that researchers measure dispersion.
To begin, suppose that four students rate their positive mood on a scale from 1 (not at all positive) to 7 (extremely positive), as follows:

<table>
<thead>
<tr>
<th>Positive Mood</th>
<th>Sarah</th>
<th>Sun Mee</th>
<th>Josh</th>
<th>Rodney</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>7</td>
<td>6</td>
<td>2</td>
<td>5</td>
</tr>
</tbody>
</table>

(You might note that the mean for these data is 20/4, or 5.) One common measure of dispersion is the range, which is the distance between the highest and lowest scores. In the example above, the range in positive mood is 5 (that is, the highest score, 7, minus the lowest score, 2). Generally speaking, the range is a rather simplistic estimate of the variability within a group of scores. Because the range takes into account only the lowest and highest scores, it can produce a misleading picture of how different from one another scores in the dataset actually are. Note that for positive mood, most people in the example have fairly similar high scores, but using the range alone gives the impression that scores are very widely dispersed.

A more informative measure of dispersion, and the one most commonly used in psychological research, is the standard deviation. The standard deviation measures how much scores vary, on average, around the mean of the sample. There is a little hitch, however. One of the mathematical properties of the mean is that if you add up each person’s difference from the mean, the sum will always be 0. So, we cannot calculate the average difference (or deviation) from the mean and get a meaningful answer.

To get around this problem, we take each person’s difference from the mean and multiply it by itself. This removes the negative numbers, and the sum of these differences will no longer equal 0. We add these squared deviations together and then divide by the number of cases (minus 1). Finally, we take the square root of that number. Essentially, then, the standard deviation is the square root of the average squared deviation from the mean. The smaller the standard deviation, the less variability in the dataset. A small standard deviation indicates that, on average, scores are close to the mean.

The following table presents the information needed to calculate the standard deviation for the positive mood ratings given above.

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participant</td>
<td>Rating</td>
<td>Difference from the mean (5)</td>
</tr>
<tr>
<td>Sarah</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>Sun Mee</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Josh</td>
<td>2</td>
<td>-3</td>
</tr>
<tr>
<td>Rodney</td>
<td>5</td>
<td>0</td>
</tr>
</tbody>
</table>

\[
\text{MEAN} = \frac{7 + 6 + 2 + 5}{4} = 5.0 \quad \text{Sum of this column} = 0 \quad \text{Sum of these differences} = 4 + 1 + 9 + 0 = 14
\]

Column A presents the ratings by each participant. Column B shows the differences of these scores from the mean (5). Notice that if we add up Column B, the answer is 0. Column C shows the squared deviations from the mean for each participant. Adding up those squared differences, we get 14. Next, we divide 14 by the number of participants minus 1, in this case 14 divided by 3 = 4.67, and then we take the square root of that number, which is 2.16. This is the standard deviation of our sample, which, compared to the range of 5, tells us that the group is actually fairly closely arranged around the mean.
The mean and standard deviation together yield a lot of information about a sample. Indeed, given the raw scores, the means, and the standard deviations of two variables, we can calculate the correlation coefficient in no time. The correlation coefficient is not a descriptive statistic but rather an inferential statistic, our next topic.

Inferential Statistics

Imagine that, inspired by the research of Lee Anne Harker and Dacher Keltner on college yearbooks (see p. 566), you conduct a study on the relationship between expressions of positive emotion and interpersonal success. In your project, you videotape job candidates being interviewed, code the videos for Duchenne smiling by the candidates, and document which of the job seekers were called back for a second interview. Let’s say you calculate that the mean number of smiles for candidates who were not called back was 3.5, and the mean number of smiles for candidates who were called back was 6.5. So, those who were called back generated, on average, 3 more smiles than those who were not called back. Does that difference matter? It seems pretty big, but is it big enough? Could we have obtained the same difference simply by chance?

To draw conclusions about differences we observe in studies, we want to know that the difference is likely to be one that can be replicated or found consistently in a variety of studies. Inferential statistics are the tools that help us to state whether a difference is unlikely to be the result of chance. More specifically, inferential statistics are the mathematical methods used to indicate whether data sufficiently support a research hypothesis (Kiss & Green, 2010).

The logic behind inferential statistics is relatively simple. Inferential statistics yield a statement of probability about the differences observed between two or more groups; this probability statement gives the odds that the observed differences were due simply to chance. In psychological research the standard is that if the odds are 5 out of 100 (or .05) or less that the differences are due to chance, the results are considered statistically significant. In statistical language, this is referred to as the .05 level of statistical significance, or the .05 confidence level. Put another way, statistical significance means that the differences observed between two groups are large enough that it is highly unlikely that those differences occur merely due to chance. The .05 level of statistical significance is considered the minimum level of probability that scientists will accept for concluding that the differences observed are real, thereby supporting a hypothesis.

Recall that although we study a sample, we typically wish to generalize our findings to a population. Inferential statistics are the bridge between a sample and a population, because they tell us the likelihood that the results we found with a sample reflect differences in the larger population. It makes sense that the larger our sample is, the more likely it is to represent that population. Thus, significance tests are based in part on the number of cases in a sample. The higher the number of cases, the easier it is to get statistical significance. As a result, with a very large sample, even very small differences may be significant.

However, statistical significance is not the same thing as real-world significance. Even if a difference is found to be statistically significant, its real-world value remains to be evaluated by critically thinking scientists.

Correlational Research

We have seen that descriptive research tells us about the basic dimensions of a variable. In contrast, correlational research tells us about the relationship between two variables. The purpose of correlational research is to examine whether and how two variables change together. That is, correlational research looks at a co-relationship. For instance, if one of the variables increases, what happens to the other one? When two variables

- inferential statistics Mathematical methods that are used to indicate whether results for a sample are likely to generalize to a population.

- correlational research Research that examines the relationships between variables, whose purpose is to examine whether and how two variables change together.
change together, we can predict one from the other, and we say that the variables are correlated.

Correlational research is so named because of the statistical technique correlation that is typically used to analyze these types of data. The key feature of a correlational study is that the factors of interest are measured or observed to see how they are related (Kiess & Green, 2010; Levin & Fox, 2011). If we wanted to know whether shy people are happy, we might give the same people two questionnaires—one that measures shyness and another that measures happiness. For each person we would have two scores, and we would then see whether shyness and happiness relate to each other in a systematic way.

The degree of relationship between two variables is expressed as a numerical value called a correlational coefficient, which is most commonly represented by the letter $r$. The correlation coefficient is a statistic that tells us two things about the relationship between two variables—its strength and its direction. The value of a correlation always falls between $-1.00$ and $+1.00$. The number or magnitude of the correlation tells us about the strength of the relationship. The closer the number is to $±1.00$, the stronger the relationship. The sign ($+$ or $-$) tells us about the direction of the relationship between the variables. A positive sign means that as one variable increases, the other also increases. A negative sign means that as one variable increases, the other decreases. A zero correlation means that there is no systematic relationship between the variables.

Examples of scatter plots (a type of graph that plots scores on the two variables) showing positive and negative correlations appear in Figure 3. Note that every dot in this figure represents both scores for one person.

**Figure 3** Scatter Plots Showing Positive and Negative Correlations

A positive correlation is a relationship in which two factors vary in the same direction, as shown in the two scatter plots on the left. A negative correlation is a relationship in which two factors vary in opposite directions, as shown in the two scatter plots on the right.
CORRELATION IS NOT CAUSATION

Look at the terms in bold type in the following newspaper headlines:

Researchers Link Coffee Consumption to Cancer of Pancreas

Brain Size Is Associated with Gender

Psychologists Discover Relationship Between Religious Faith and Good Health

Reading these headlines, one might conclude that coffee causes pancreatic cancer, gender causes differences in brain size, and religious faith causes good health. The boldface words are synonymous only with correlation, however, not with causality.

_Correlation does not equal causation._ Remember, correlation means only that two variables change together. Being able to predict one event based on the occurrence of another event does not necessarily tell us anything about the cause of either event (Aron, Aron, & Coups, 2011; Heiman, 2011). At times some other variable that has not been measured accounts for the relationship between two others. Researchers refer to this circumstance as the **third variable problem**.

To understand the third variable problem, consider the following example. A researcher measures two variables: the number of ice cream cones sold in a town and the number of violent crimes that occur in that town throughout the year. The researcher finds that ice cream cone sales and violent crimes are positively correlated, to the magnitude of +.50. This high positive correlation would indicate that as ice cream sales increase, so does violent crime. Would it be reasonable for the local paper to run the headline “Ice Cream Consumption Leads to Violence”? Should concerned citizens gather outside the local Frosty Freeze to stop the madness? Probably not. Perhaps you have already thought of the third variable that might explain this correlation—heat. Indeed, when it is hot outside, people are more likely both to purchase ice cream and to act aggressively (Anderson & Bushman, 2002). Such a third variable is also called a **confound**.

THE VALUE OF CORRELATIONAL RESEARCH

Given the potential problems with third variables, why do researchers bother to conduct correlational studies? There are several very good reasons. Although correlational studies cannot show a causal relationship between variables, they do allow us to use one variable to predict a person’s score on another. This is the reasoning behind tests such as the SAT and ACT, which provide a measure of academic ability that will predict performance in college. In addition, some important questions can be investigated only through correlational studies. Such questions may involve variables that can only be measured or observed, such as biological sex, personality traits, genetic factors, and ethnic background. Another reason why researchers conduct correlational studies is that sometimes the variables of interest are real-world events that influence people’s lives, such as Hurricane Katrina in 2005 and the earthquake in Haiti in 2010. Correlational research is also valuable in cases where it would not be ethical to do research in any other way. For example, it would be unethical for an experimenter to direct expectant mothers to smoke varying numbers of cigarettes in order to see how cigarette smoke affects birth weight and fetal activity.

Although we have predominantly focused on relationships between just two variables, researchers often measure many variables in their studies. This way, they can examine whether a relationship between two variables is explained by a third variable (or a fourth or fifth variable). An interesting question that researchers have probed in this fashion is, do happy people live longer? In one study, 2,000 Mexican Americans aged 65 and older were interviewed twice over the course of two years (Ostir & others, 2000). In the first assessment, participants completed measures of happiness but also reported about potential third variables such as diet, physical health, smoking, marital status, and distress. Two years later, the researchers contacted the participants again to see who was still alive. Even with these many potential third variables taken into account, happiness predicted who was still living two years later.
Correlational studies are useful, too, when researchers are interested in studying everyday experience. For example, correlational researchers have begun to use daily journal keeping, known as the experience sampling method (ESM), to study people in their natural settings. ESM studies involve having people report on their experiences in a diary a few times a day or to complete measures of their mood and behavior whenever they are beeped by an electronic organizer. A similar method, events-contingent responding, asks participants to complete a report each time they engage in a particular behavior, such as drinking alcohol or having sex (Cooper, 2010). Such methods allow researchers to get close to real life as it happens.

Although the correlation coefficient is often used to express the relationship between two variables, it is important to keep in mind that what makes a study correlational is not the statistic researchers use to analyze the data. Rather, a study is correlational when it relies on measuring variables to see how they are related. To get a sense of this distinction and learn about some clever ways in which psychologists have operationalized variables, check out the Psychological Inquiry on p. 71.

5. CONDUCTING ETHICAL RESEARCH

Ethics is a crucial consideration for all science. This fact came to the fore in the aftermath of World War II, for example, when it became apparent that Nazi doctors had used concentration camp prisoners as unwilling participants in experiments. These atrocities spurred scientists to develop a code of appropriate behavior—a set of principles about the treatment that participants in research have a right to expect. In general, ethical principles of research focus on balancing the rights of the participants with the rights of scientists to ask important research questions (Smith & Davis, 2010).

The issue of ethics in psychological research may affect you personally if at some point you participate in a study. In that event, you need to know your rights as a participant and the researchers' responsibilities in ensuring that these rights are safeguarded. Experiences in research can have unforeseen effects on people's lives.

One investigation of young dating couples asked them to complete a questionnaire that coincidentally stimulated some of the participants to think about potentially troublesome issues in the relationship (Rubin & Mitchell, 1976). One year later, when the researchers followed up with the original sample, 9 of 10 participants said they had discussed their answers with their dating partners. In most instances, the discussions helped to strengthen the relationships. In some cases, however, the participants used the questionnaire as a springboard to discuss problems or concerns previously hidden. One participant said, "The study definitely played a role in ending my relationship with Larry." In this case, the couple had different views about how long they expected to be together. She was thinking of a short-term dating relationship, whereas he was thinking in terms of a lifetime. Their answers to the questions brought the disparity in their views to the surface and led to the end of their relationship. Researchers have a responsibility to anticipate the personal problems their study might cause and, at least, to inform the participants of the possible fallout.

Ethics comes into play in every psychological study. Even smart, conscientious students sometimes think that members of their church, athletes in the Special Olympics, or residents of the local nursing home present great samples for psychological research. Without proper permission, though, the most well-meaning, kind, and considerate researchers still violate the rights of the participants.
Ethics Guidelines

A number of guidelines have been developed to ensure that research is conducted ethically. At the base of all of these guidelines is the notion that a person participating in psychological research should be no worse off coming out of the study than he or she was on the way in.

Today colleges and universities have a review board (typically called the institutional review board, or IRB) that evaluates the ethical nature of research conducted at their institutions. Proposed research plans must pass the scrutiny of a research ethics committee before the research can be initiated. In addition, the American Psychological Association (APA) has developed ethics guidelines for its members. The code of ethics instructs psychologists to protect their participants from mental and physical harm. The participants' best interests need to be kept foremost in the researcher's mind (Gravetter, 2009; Ray, 2009). The APA's guidelines address four important issues:

- **Informed consent:** All participants must know what their participation will involve and what risks might develop. For example, participants in a study on dating should be told beforehand that a questionnaire might stimulate thoughts about issues in their relationships that they have not considered. Participants also should be informed that in some instances a discussion of the issues might improve their relationships but that in others it might worsen the relationships and even end them. Even after informed consent is given, participants must retain the right to withdraw from the study at any time and for any reason.

- **Confidentiality:** Researchers are responsible for keeping all of the data they gather on individuals completely confidential and, when possible, completely anonymous. Confidential data are not the same as anonymous. When data are confidential, it is possible to link a participant's identity to his or her data.

- **Debriefing:** After the study has been completed, the researchers should inform the participants of its purpose and the methods they used. In most cases, the experimenters also can inform participants in a general manner beforehand about the purpose of the research without leading the participants to behave in a way that they think that the experimenters are expecting. When preliminary information about the study is likely to affect the results, participants can at least be debriefed after the study's completion.

- **Deception:** This is an ethical issue that psychologists debate extensively. In some circumstances, telling the participants beforehand what the research study is about substantially alters the participants' behavior and invalidates the researcher's data. For example, suppose a psychologist wants to know whether bystanders will report a theft. A mock theft is staged, and the psychologist observes which bystanders report it. Had the psychologist informed the participants beforehand that the study intended to discover the percentage of bystanders who will report a theft, the whole study would have been ruined. Thus, the researcher deceives participants about the purpose of the study, perhaps leading them to believe that it has some other purpose. In all cases of deception, however, the psychologist must ensure that the deception will not harm the participants and that the participants will be told the true nature of the study (will be debriefed) as soon as possible after the study is completed.

The federal government also takes a role in ensuring that research involving human participants is conducted ethically. The Office for Human Research Protection is devoted to ensuring the well-being of participants in research studies. Over the years, the office has dealt with many challenging and controversial issues—among them, informed consent rules for research on mental disorders, regulations governing research on pregnant women and fetuses, and ethical issues regarding AIDS vaccine research.

For generations, psychologists have used animals in some research. Animal studies have provided a better understanding of and solutions for many human problems (Pinel, 2009).
Would Reality TV Pass the Institutional Review Board?

Survivor, American Idol, Big Brother—these are just a few of the many popular reality shows that fill the U.S. television airwaves. While critics debate the quality of these shows, reality TV watchers may think that they are learning a lot about human nature by tuning in to see who will get voted off, who will willingly eat ground-up rats, or who will be ridiculed by the American Idol judges.

For you as a student of psychology, an appropriate question might be, would these reality TV shows ever gain the approval of the IRB of an institution of higher learning? This issue was of interest to Barbara Spellman, a founding member of the American Psychological Society Committee on Human Subject Protection, who examined reality TV programming with an eye toward the ethical issues these shows present. If we were to consider reality TV from the perspective of the APA ethical guidelines we have considered in this chapter, at least five issues that Spellman (2005) identified would come to the fore.

First, how do reality shows achieve informed consent? The principle of informed consent means that all participants must know what their participation will involve and what risks might develop. Yet the thing that makes reality shows exciting is the element of the unknown—the potential for surprise. Clearly the producers of Survivor are not going to inform contestants upfront that for their particular episode they will be asked to eat live bugs, because the element of shock and the dramatic moment of the decision would diminish greatly if it occurred off camera while the person purused the consent form. On the other hand, we might note that it is highly unlikely that anyone who participates on such a show has not watched a few episodes, and therefore most participants will have a pretty good idea that they must expect the unexpected.

A second, related problem with at least some reality shows is the use of deception. Fooling a group of women into believing that a semi-employed construction worker is actually a millionaire is probably not likely to satisfy APA ethical considerations.

A third issue that might arise is that of risk. Many reality shows pose a great deal of psychological and/or physical risk. Some reality shows include children (for example, Wife Swap), and it is very unlikely that an IRB would consider posing any kind of risk to children justified.

A fourth major stumbling block for reality TV is the potential for huge cash awards to compel people to behave in ways they would not otherwise do. Is it "really" lying if you are doing it in order to win a million dollars? If a person does something to "play the game" that he or she would never do outside of the game, haven't we shown that money has compelled the individual to act in ways he or she might later regret or be judged for?

Remember that ethical considerations involve balancing the rights of participants with the scientist's right to know. Thus, a fifth question pertinent to a study of reality TV is, what is the value of what we can learn from these "experiments"? This brings up the issue of how "natural" reality shows are. Are people truly themselves when the cameras are rolling?

**What Do You Think?**

- Do reality TV shows represent natural human behavior? Explain.
- What kind of reality show would you design if you were interested in exploring important psychological processes? What ethical safeguards would you build into the design to protect participants?
Neal Miller (1985), who has made important discoveries about the effects of biofeedback on health, listed the following areas in which animal research has benefited humans:

- Psychotherapy techniques and behavioral medicine
- Rehabilitation of neuromuscular disorders
- Alleviation of the effects of stress and pain
- Drugs to treat anxiety and severe mental illness
- Methods for avoiding drug addiction and relapse
- Treatments to help premature infants gain weight so they can leave the hospital sooner
- Methods used to alleviate memory deficits in old age

About 5 percent of APA members use animals in their research. Rats and mice account for 90 percent of all psychological research with animals. It is true that researchers sometimes use procedures with animals that would be unethical with humans, but they are guided by a set of standards for housing, feeding, and maintaining the psychological and physical well-being of their animal subjects. Researchers are required to weigh potential benefits of the research against possible harm to the animal and to avoid inflicting unnecessary pain. In short, researchers must follow stringent ethical guidelines, whether animals or humans are the subjects in their studies.

The Place of Values in Research

Questions are asked not only about the ethics of psychology but also about its values and its standards for judging what is worthwhile and desirable. Some psychologists argue that psychology should be value-free and morally neutral. From their perspective, the psychologist's role as a scientist is to present facts as objectively as possible. Others believe that because psychologists are human, they cannot possibly be value-free. Indeed, some people go so far as to argue that psychologists should take stands on certain issues. For example, psychological research shows that children reared by gay male and lesbian parents are no more likely to be gay than other children and tend to show levels of psychological health that are equal to or higher than those of children reared by heterosexual parents (Patterson & Hastings, 2007). To the extent that some have argued against the rights of gays and lesbians to adopt children or to retain custody of their biological children, psychologists may have a role to play in the debate about these issues.

To explore questions about the ethics of research further, read the Critical Controversy feature about reality TV.

6. THINKING CRITICALLY ABOUT RESEARCH FINDINGS

Not all psychological information that is presented for public consumption comes from professionals with excellent credentials and reputations at colleges or universities or in applied mental health settings (Stanovich, 2010). Because journalists, television reporters, and other media personnel are not usually trained in psychological research, they often have trouble sorting through the widely varying material they find and making sound decisions about the best information to present to the public. In addition, the media often focus on sensationalistic and dramatic psychological findings to capture public attention. Media reports may go beyond what actual research articles and clinical findings really say. The popular media latched on to this work, although subsequent research has called its conclusions into question.

Even when the media present the results of excellent research, they sometimes have trouble accurately informing people about the findings and their implications.
for people's lives. This entire book is dedicated to carefully introducing, defining, and elaborating on key concepts and issues, research, and clinical findings. The media, however, do not have the luxury of so much time and space to detail and specify the limitations and qualifications of research. In the end, you have to take responsibility for evaluating media reports on psychological research. To put it another way, you have to consume psychological information critically and wisely. Five guidelines follow.

Avoid Overgeneralizing Based on Little Information

Media reports of psychological information often leave out details about the nature of the sample used in a given study. Without information about sample characteristics—such as the number of participants, their sex, or their ethnic representation—it is wise to take research results with a grain of salt. For example, research that demonstrated the classic "fight or flight" response to stress has had great impact on how we understand the body's response to threatening situations. Yet the original work on this topic included only male participants (Taylor, 2011).

Distinguish Between Group Results and Individual Needs

Just as we cannot generalize from a small group to all people, we also cannot apply conclusions from a group to an individual. When you learn about psychological research through the media, you might be disposed to apply the results to your life. It is important to keep in mind that statistics about a group do not necessarily represent each individual in the group equally well. Imagine, for example, taking a test in a class and being told that the class average was 75 percent, but you got 98 percent. It is unlikely that you would want the instructor to apply the group average to your score.

Sometimes consumers of psychological research can get the wrong idea about whether their own experience is "normal" if it does not match group statistics. New parents face this issue all the time. They read about developmental milestones that supposedly characterize an entire age group of children; one such milestone might be that most 2-year-olds are conversing with their parents. However, this group information does not necessarily characterize all children who are developing normally. Albert Einstein did not start talking until he was the ripe old age of 3.

Look for Answers Beyond a Single Study

The media might identify an interesting piece of research and claim that its conclusions are phenomenal and have far-reaching implications. Although such pivotal studies do occur, they are rare. It is safer to assume that no single study will provide conclusive answers to an important question, especially answers that apply to all people. In fact, in most psychological domains that prompt many investigations, conflicting results are common. Answers to questions in research usually emerge after many scientists have conducted similar investigations that yield similar conclusions. Remember that you should not take one research study as the absolute, final answer to a problem, no matter how compelling the findings.
Avoid Attributing Causes Where None Have Been Found

Drawing causal conclusions from correlational studies is one of the most common mistakes the media make. For example, the results of the Nun Study described earlier suggest that happy people live longer. However, we cannot state that happiness caused them to live longer. When a true experiment has not been conducted—that is, when participants have not been randomly assigned to treatments or experiences—two variables might have only a non-causal relationship to each other. Remember from the discussion of correlation earlier in the chapter that causal interpretations cannot be made when two or more factors are simply correlated. We cannot say that one causes the other. When you hear about correlational studies, be skeptical of words indicating causation until you know more about the particular research.

Consider the Source of Psychological Information

Studies conducted by psychologists are not automatically accepted by the rest of the research community. The researchers usually must submit their findings to an academic journal for review by their colleagues, who make a decision about whether to publish the paper, depending on its scientific merit. Although the quality of research and findings is not uniform among all psychology journals, in most cases journals submit the findings to far greater scrutiny than do the popular media (Stanovich, 2010).

Within the media, though, you can usually draw a distinction. The reports of psychological research in respected newspapers such as the New York Times and the Washington Post, as well as in credible magazines such as Time and the Atlantic Monthly, are far more trustworthy than reports in tabloids such as the National Enquirer and Star. Yet whatever the source—serious publication, tabloid, or even academic journal—you are responsible for reading the details behind the reported findings and for analyzing the study’s credibility.

7. THE SCIENTIFIC METHOD AND HEALTH AND WELLNESS

Throughout this book we examine a host of ways that psychological research has implications for health and wellness. In this chapter’s concluding section, we focus on a research topic in which the scientific method has played a particularly important role in the conclusions drawn—the power of expressive writing to enhance health and wellness.

James Pennebaker has conducted a number of studies that converge on the same conclusion: that writing about one’s deepest thoughts and feelings concerning one’s most traumatic life event leads to a number of health and well-being benefits (Pennebaker & Chung, 2007). This research began with a correlational study comparing two groups of individuals—those who had lost a spouse to suicide and those who had lost a spouse to an accident (Pennebaker & O’Heeron, 1984). The results of the study showed that survivors of a suicide were more likely to have become sick in the months after the death, compared to accident survivors. Importantly, the difference was explained by the fact
that individuals whose spouses had committed suicide were much less likely to talk about their loss, compared to the other participants.

These correlational findings led Pennebaker to wonder whether it might be possible to manipulate expressing one’s thoughts and feelings about a traumatic event experimentally and thereby to receive the benefits of socially sharing the trauma. So, in subsequent studies, participants have been randomly assigned to write about one of two topics—either the individual’s most traumatic life event or a relatively uninteresting topic (for example, his or her plans for the day). Assignment of the specific topic is meant to control for the act of writing itself so that the control group is as much like the experimental group as possible (Baddeley & Pennebaker, 2009; Pennebaker & Graybeal, 2001).

The participants write about the same topic for three or four consecutive days for about 20 minutes each day. Weeks or months after writing, participants in the trauma writing group have better physical health than those in the control group. Since the first traumatic writing study, a host of researchers have replicated these effects, showing that writing about trauma is associated with superior immune function, better response to a vaccine, higher psychological well-being, better adjustment to coming to college, and more quickly finding employment after being laid off from work (Lepore & Smyth, 2002; Pennebaker, 1997a, 1997b, 2004). Thus, we might conclude that documenting one’s deepest thoughts and feelings about traumatic life events is necessary to attain the “healing power” of writing.

Note, however, that the participants in the trauma group were not just writing about a trauma. They were also documenting an important personal experience. Thinking about these results in terms of the internal validity of the conclusions, we might ask if focusing on a trauma is the key ingredient in producing health benefits. Might there be other, less negative aspects of life that are equally meaningful and that might promote good health when they are the subject of personal writing? Indeed, subsequent research shows that health benefits can emerge from writing about a variety of topics, including how one has grown from a negative experience (King & Miner, 2000; Low, Stanton, & Danoff-Burg, 2006), one’s life dreams (King, 2001), and one’s most intensely positive experiences (Burton & King, 2004, 2009). In a recent study, participants who wrote about either a traumatic life event or an extremely positive event for just two minutes a day over two days reported fewer illnesses a month later (Burton & King, 2008).

The body of evidence for the effects of expressive writing on health is substantial and has been subjected to two meta-analyses, the procedure described earlier in this chapter. These meta-analyses indicate that individuals who write over days that are spaced apart tend to benefit most from writing, and that feeling distressed while writing is not necessary to enjoy these benefits (Frattaroli, 2006; Smyth, 1998).

If you would like to explore the healing power of writing in your own life, use the simple guidelines below:

- Find a quiet place to write.
- Pick just one topic to explore through writing.
- Dedicate yourself to a few minutes of writing each day, perhaps writing once a week for a few weeks.
- While writing, do not worry about punctuation, grammar, or spelling—just let yourself go and write about all of the thoughts, emotions, and feelings associated with the experience you are documenting.
- If you feel that writing about something negative is not for you, try writing about your most positive life experiences, the people you care about, or all the things for which you feel grateful.
The long and growing literature on the effects of expressive writing on health demonstrates how research methods influence the conclusions that scientists reach and how the process of scientific research builds from one study to the next. This literature also demonstrates how psychological research is relevant to the daily life of everyone with a story to write—and how an individual can benefit from writing that story.

1. STATISTICAL INFERENCE IN DECISION MAKING

Psychologists use the scientific method to address research questions. This method involves starting with a theory and then making observations, formulating hypotheses, testing these through empirical research, drawing conclusions, and evaluating the theory. The science of psychology is an ongoing conversation among scholars.

2. TYPES OF RESEARCH IN BUSINESS

Three types of research commonly used in psychology are descriptive research (finding out about the basic dimensions of some variable), correlational research (finding out if and how two variables change together), and experimental research (determining the causal relationship between variables). Descriptive research includes observation, surveys, interviews, and case studies. Correlational research often includes surveys and interviews as well as observation. Experimental research occurs in a lab but can also be done in a natural setting.

In an experiment, the independent variable is manipulated to see if it produces changes in the dependent variable. An experiment involves comparing two groups: the experimental group (the one that receives the treatment or manipulation of the independent variable) and the control group (the comparison group or baseline that is equal to the experimental group in every way except for the independent variable). Experimental research relies on random assignment to ensure that the groups are roughly equivalent before the manipulation of the independent variable.

3. RESEARCH SAMPLES AND SETTINGS

Two important decisions that must be made for psychological research are whom to study and where to study them. A sample is the group that participates in a study; a population is the group to which the researcher wishes to generalize the results. A random sample is the best way of ensuring that the sample reflects the population.

Research settings include both the laboratory and real-world, naturalistic contexts. The laboratory allows a great deal of control, but naturalistic settings may give a truer sense of natural behavior.

4. ANALYZING AND INTERPRETING DATA

Descriptive statistics are used to describe and summarize samples of data in a meaningful way. Two types of descriptive statistics are measures of central tendency and measures of variability. Measures of central tendency are the mean (or mathematical average), the median (the middle score), and the mode (the most common score). Measures of variability include the range (the difference between the highest and lowest scores) and the standard deviation (the square root of the average squared deviation from the mean).

Inferential statistics are used to draw conclusions about data. Inferential statistics aim to uncover statistical significance, which means that the differences observed between groups (or the correlation between variables) are unlikely to be the result of chance.

5. CONDUCTING ETHICAL RESEARCH

For all kinds of research, ethical treatment of participants is crucial. Participants should leave a psychological study no worse off than they were when they entered. Some guiding principles for ethical research in psychology include informed consent, confidentiality, debriefing (participants should be fully informed about the purpose of a study once it is over), and explaining fully the use of deception in a study.

6. THINKING CRITICALLY ABOUT RESEARCH FINDINGS

In your everyday life and in introductory psychology, you will be exposed to psychological research findings. In approaching psychological research in the media, you should adopt the attitude of a scientist and critically evaluate the research presented. This means being careful to avoid oversimplifying based on little information, realizing that group results may not apply to every individual, looking for answers beyond a single study, and avoiding attributing causation when none has been found. Finally, it is important to consider the source when you encounter research in the popular media.

7. THE SCIENTIFIC METHOD AND HEALTH AND WELLNESS

A great deal of psychological research has relevance to health and wellness. An example is research by James Pennebaker on the effects of expressive writing on health and well-being. This research has shown that individuals who are randomly assigned to write about a traumatic life event for a few minutes a day over three or four days show a host of health and well-being benefits compared to those in a control condition. Subsequent research has shown that these health benefits can be obtained by writing about very positive life experiences and even just writing for a couple of minutes.

This research demonstrates how a research question can begin as a correlational study and then move to the laboratory to demonstrate causation. When many studies have been done on a topic, a meta-analysis can provide a sense of the overall importance of the results. This example also shows how psychological research can have important implications for everyday life.
key terms

- variable, p. 564
- quasi-experiment, p. 572
- theory, p. 564
- random assignment, p. 572
- hypothesis, p. 565
- independent variable, p. 572
- constructs, p. 565
- confounding variable, p. 572
- operational definition, p. 565
- confederate, p. 572
- meta-analysis, p. 567
- dependent variable, p. 572
- descriptive research, p. 567
- experimental group, p. 573
- case study or case history, p. 568
- control group, p. 573
- longitudinal design, p. 570
- between-participant design, p. 573
- cross-sectional design, p. 570
- within-participant design, p. 573
- true experiment, p. 571
- external validity, p. 573
- naturalistic observation, p. 579
- internal validity, p. 573
- descriptive statistics, p. 579
- demand characteristics, p. 573
- experimenter bias, p. 573
- inferential statistics, p. 583
- research participant bias, p. 575
- mean, p. 581
- placebo effect, p. 575
- median, p. 581
- placebo, p. 575
- mode, p. 581
- double-blind experiment, p. 575
- range, p. 582
- population, p. 577
- standard deviation, p. 582
- sample, p. 577
- third variable problem, p. 585
- random sample, p. 577

apply your knowledge

1. It's time to get out those old photos from the prom, wedding, or family reunion and see just how happy people were (or weren't). Look at some pictures from your own life and see who was genuinely smiling and who was faking it. Just cover the mouths with your finger—you can see who is happy from their eyes.

2. Is an old diary of yours hanging around somewhere? Pull it out and take a look at what you wrote. Count up your positive emotion words or negative emotion words. Are there themes in your diary from years ago that are still relevant to your life today? Does looking at your own diary change the way you might think about the results of the Nun Study? Explain.

3. What are some positive and negative correlations that you have observed in your own experience? What are some third variables that might explain these relationships? Do you think these relationships may be causal? How would you design an experiment to test that possibility?

4. In the next few days, look through several newspapers and magazines for reports about psychological research. Also notice what you see and hear on television about psychology. Apply the guidelines for being a wise consumer of information about psychology to these media reports.

5. The study of the Olympic athletes that was described at the beginning of this chapter was a correlational study. Design an experiment that would test the prediction that those who finish second are likely to be less happy than those who finish third.

6. Pick a topic of interest to you and define the variables. Then list as many ways to operationalize the variables as you can. Come up with at least one behavioral measure of the variable. Would your topic be best studied using a correlational or an experimental method? How would you conduct the study?