

The Vehicle for Psychological Discovery



Chapter Outline

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- e Meta-Analysis Statistically Summarizes the Findings Across Many Studies.
- f There Are No "Final Truths" in Science.

2.3 Commonly Used Scientific Methods

- a Description Is the Goal of Observational Research.
- b Correlational Research Analyzes the Nature of the Relationship Between Variables.
- c Experimental Research Determines Cause-Effect Relationships.

Psychological Applications: How Can You Develop Critical Thinking Skills?

2015 online survey (see Figure 2-1) revealed that almost 9 out of 10 U.S. adults want candidates for public office to possess a basic understanding of science as part of making public policy decisions (Goddard, 2015). This desire stands in stark contrast to what appears to be a disturbing lack of respect for, and knowledge of, science and the work of scientists on the part of some contemporary U.S. politicians (Rosenberg et al., 2015). For example, at the national level, Senator Ted Cruz has threatened to cut government funding for scientific research on the topic of climate change. Similarly, former presidential candidate Ben Carson has stated that he does not believe in the theory of evolution. At the state level, former Delaware Senate candidate Christine O'Donnell

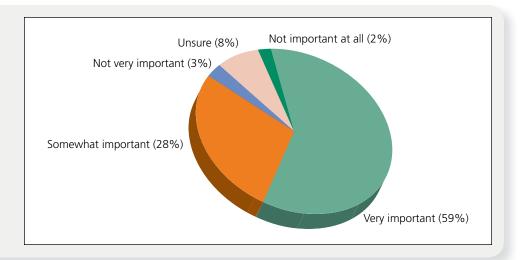
ridiculed the overwhelming scientific evidence for the theory of evolution by arguing, "You know what? Evolution is a myth... Why aren't monkeys still evolving into humans?"

Of course, such expressions of scientific ignorance are not typical of either contemporary or past politicians. The third president of the United States, Thomas Jefferson, had a lifelong passion for science and scientific inquiry and was president of the American Philosophical Society. Similarly, our 16th president, Abraham Lincoln, created the National Academy of Sciences during his time in office. Good leaders recognize the important role that science plays in fostering human health and welfare. In this chapter, we will examine some of the basic tenets of scientific inquiry.

FIGURE 2-1

How Important
Do You Think It Is
that Candidates
for President and
Congress Have a
Basic Understanding
of the Science
Informing Public
Policy Issues?

Source: A Research! America and ScienceDebate.org poll of U.S. adults conducted in partnership with Zogby Analytics in September 2015.



2.1 Is Psychology Just Common Sense?



- * What are some "common" flaws in commonsense thinking?
- * How do psychologists try to avoid the flaws of everyday thinking in their study of the mind?

How do people react when they learn that you are enrolled in a psychology course? Based on our society's voracious appetite for "pop psychology" like talk radio shows and self-help books, I'm sure some of your friends and family members are intrigued—and perhaps a bit envious—about what you might learn in the coming months. Others, in contrast, might dismiss what psychology has to offer as merely "warmed-over common sense." One reason some people think of psychology as simply rephrasing what we already know is that its subject matter is so personal and familiar—we all informally think about our own thoughts, feelings, and actions, and those of others (Lilienfeld, 2012). Why would such informally obtained knowledge be appreciably different from what psychologists achieve through their scientific observations? Let's examine how the scientific inquiry adopted by psychology is different from the much more casual analysis that we often employ in our everyday thinking.

2.1a We Often Understand Our World Based on a "Naive" Psychology.

All of us spend considerable time and energy gathering, analyzing, and interpreting information to better understand our world and the people who inhabit it. An important product of this informal journey of discovery is the development of certain assumptions or belief systems about how people function on the psychological level. In most cases, these beliefs are best characterized as being embedded within a *naive psychology*—that is, instead of being based on careful scientific analysis, they develop from everyday experiences and uncritical acceptance of other people's views and opinions. Although these commonsense psychological beliefs often result in good decision-making, they can also produce distorted judgments. To illustrate some of the pitfalls of naive psychology, let's briefly examine how we typically judge other people's personalities and how we generally overestimate our knowledge of how people and the world operate.

Common Mistakes in Assessing Personality

Research indicates that the first bits of information we learn about a person carry more weight in forming an overall impression than information learned later. Thus, if a stranger were described to you as intelligent, industrious, impulsive, critical, stubborn, and envious, your overall impression of her might be more favorable than if she were described as envious, stubborn, critical, impulsive, industrious, and intelligent. Although the information contained in these two descriptions is identical, psychological research has found that a person described in the first manner is typically thought to be competent and ambitious, while a person described in the reverse order is more likely to be considered overemotional and socially maladjusted (Asch, 1946).

Why does early information figure more prominently than later information in our impression of others? One possible explanation for this *primacy effect* (see Chapter 8, Section 8.1a) is that the early bits of information provide a mental "outline" in memory, which we then use to process later information (Van Overwalle & Labiouse, 2004). If the later information contradicts this outline, we are more likely to ignore it. The primacy effect is particularly strong when people are given little time to make judgments and are not under a great deal of pressure to be correct. There is also evidence that people who are most likely to seize the early information they learn about others and then freeze it into quick personality judgments are those with a strong need for certainty in their lives (Kruglanski & Webster, 1996). Quick personality judgments provide these individuals with a reassuring belief that they understand other people.

Our everyday personality judgments are shaped, not only by the order in which we learn information about others, but also by our prior set of beliefs about which personality traits go together. These assumptions or naive belief systems that we have about the associations among personality traits have been called an **implicit personality theory**. In this unscientific theory of personality, we have a strong tendency to assume that all good things occur together in persons and that all bad things do so as well, with little overlap between the two (Choi et al., 2002). Thus, we are likely to believe that someone whom we perceive as warm and outgoing could not also be prone to violence. Implicit personality theory appears to have an operating principle of *evaluative consistency*—the tendency to view others in a way that is internally consistent. Even when contradictory information is provided, we still generally persist in viewing people as consistently either good or bad. In seeking consistency, we often distort or explain away contradictory information (Plaks et al., 2005).

Research suggests that the use of implicit personality theories contributes to the high rates of sexually transmitted diseases among adolescents and young adults. The Centers for Disease Control and Prevention (CDC) estimates that 19 million new cases of sexually transmitted diseases occur annually in the United States, with almost half occurring among 15- to 24-year-olds (Weinstock et al., 2000). One of the primary reasons why youth are overrepresented in these disease categories is that many of them are not practicing safe sex (Kalichman, 2000). A survey conducted by Sunyna S. Williams and her colleagues (1992) found that many youths have a well-developed set of ideas—an implicit personality theory—regarding which potential sexual partners are safe and which are not. Who are these sexually "safe" persons? Can you guess, based on information in the previous paragraph? People one knows and likes are perceived not to be a risk, while risky people are those one does not know well, those who are older, or those who are overanxious for sex. Kimble and her coworkers attributed the young people's tendencies not to practice safe sex with partners they knew and liked to their reluctance to link the risk of disease with loving or caring relationships. Unfortunately, the criteria these people use to judge risk for sexually transmitted diseases are completely unrelated to a person's sexual disease status. People who use such a belief system run the very real risk of exposure to such dangerous diseases as gonorrhea, chlamydia, syphilis, hepatitis, and HIV/AIDS.

Much of what we take to be true is seriously wrong.

—Gore Vidal, U.S. author, 1925–2012

Implicit personality theory People's assumptions or naive belief systems about which

personality traits go together



Imagine that after being introduced to this person, you judged him to be warm, friendly, and outgoing. Based on this first impression, you would probably conclude that he is also honest and trustworthy because these traits are consistent with your initial evaluations. Can you think of instances in your life when your implicit personality theories have not been accurate?

Hindsight bias The tendency, once an event has occurred, to overestimate our ability to have foreseen the outcome



Journey of Discovery

The importance of Kimble's research on implicit personality theories and practicing safe sex is that it not only alerts us to how people often engage in faulty decision-making but that it also suggests how we might use this knowledge to develop intervention programs aimed at changing young adults' thinking regarding safe sex. If you were developing such a program, how would you explain to participants the role that implicit personality theory plays in their daily social judgments?

The Hindsight Bias

If you were to successfully develop an intervention program informing people about faulty decision-making regarding safe sex, participants would likely say that you were not telling them anything they didn't already know. In other words, your psychological findings would likely be seen as simply reflecting obvious commonsense notions of life. Yet, is it really true that most young adults already understand the psychological dynamics of how they judge other people and thus realize they cannot assume that others are "safe" sexual partners simply because they are likable? As we have already seen, the available evidence certainly does not support this conclusion. What else might explain this "I-knew-it-all-along" response?

Research suggests that when recalling past events, we tend to believe that we "knew all along" how things would turn out. For example, after learning the results of a local election, you might think, "I knew this would be the outcome long ago." Or, after your favorite sports team narrowly defeats its archrival for the first time in five years, you exclaim, "All week I could sense that my team was going to win!" This after-the-fact overestimation of your ability to foresee the outcome is known as the **hindsight bias** (Groß & Bayen, 2015; Villejoubert, 2005).

Why does the hindsight bias occur? Our desire for *sensemaking* fuels this bias, and we are most likely to rewrite our memory of a past event when the outcome is initially surprising (Erdfelder et al., 2007). When thinking about a past event that had a surprising outcome, we selectively recall information in constructing a plausible story that is consistent with the now-known outcome. This "rewriting" of how events occurred allows us to insert the missing causal connections so the story makes sense given the outcome. Claiming hindsight reassures us that we understand—and can anticipate—events in our world. Cross-cultural studies indicate that this bias occurs throughout the world (Pohl et al., 2002).

If you were among a group of employees laid off at work, do you think you would be more or less likely to claim that "there were many warning signals" than if you were merely an unaffected citizen of the town in which the layoffs occurred? In one study that explored this question, people living near a factory were asked questions about recent factory layoffs (Mark & Mellor, 1991). Results indicated that townspeople who did not work at the factory and were not affected by the layoffs were most likely to claim that they knew the job cuts were coming (high hindsight bias). Factory workers who kept their jobs were less likely to claim hindsight. Those who expressed the greatest surprise (no hindsight bias) were the workers who had actually lost their jobs. These results suggest that, although we often engage in hindsight bias when explaining past events, we are less likely to do so when those events affect us personally and are

negative. Is this what you predicted? Present this hypothetical situation to your friends, and have them predict the outcome. How many guessed correctly? Are these findings simply "common sense"? In hindsight, it might appear so.

Of course, not all "I-knew-it-all-along" claims are due to hindsight bias. Because we all observe and analyze the world in which we live, we are sometimes accurate in foreseeing how events will unfold. This is true for both personal and historical happenings, as well as for the findings of psychological research. However, there are other times when the scientific findings of psychology are considerably distant from anything we would have predicted based on our casual observations. This is one fact that you will be regularly reminded of as you read this textbook: Many commonsense ideas are simply a product of wrongheaded thinking. One of the objectives of psychological research is to identify and dispel these faulty commonsense beliefs.



The hindsight bias involves the tendency to overestimate your ability to have foreseen the outcome of a past event. If workers have just been told that their factory is closing, are they more or less likely than the local townspeople to claim they foresaw the layoffs?



Journey of Discovery

Having digested the research on hindsight bias, why do you think we are less likely to claim hindsight for negative outcomes that personally affect us?

2.1b Scientific Methods Minimize Error and Lead to Dependable Generalizations.

Now that we have reviewed a few ways in which our everyday thinking can lead to faulty judgments, do you think psychology has developed a special formula to eliminate these biases and errors when conducting research? The answer is no. There is no magic formula to erase these mental quirks and glitches so that our minds run with computer-like precision. Even if there were such a formula, would you be so foolhardy as to "cure" yourself in this manner? As you will discover in your journey through psychology, the quirks and glitches in our everyday thinking are important elements in what it means to be human.

While it is true that psychologists are not immune to error-prone thinking, they do use special methods to minimize these problems when conducting research. These **scientific methods** consist of a set of procedures used to gather, analyze, and interpret information in a way that reduces error and leads to dependable generalizations. By *generalizations*, I mean statements that apply to members of a group as a whole rather than to specific members.

In research, a **sample** is a group of subjects who are selected to participate in a given study, while a **population** consists of all the members of an identifiable group from which a sample is drawn. The closer a sample is in representing the population, the greater confidence researchers have in generalizing their findings beyond the sample. Researchers have the most confidence that their sample is an accurate representation of the population when everyone in the population has an equal chance of being selected for the sample. Such **random selection** of participants, although highly desirable, is not always possible. For instance, in studying the effects of using cell-phones while driving a motor vehicle, it would be impossible to design a study

Life is lived forwards, but understood backwards.

—Søren Kierkegaard, Danish philosopher, 1813–1855

Scientific methods A set of procedures used in science to gather, analyze, and interpret information in a way that reduces error and leads to dependable generalizations

Sample A group of subjects selected to participate in a research study

Population All the members of an identifiable group from which a sample is drawn

Random selection A procedure for selecting a sample of people to study in which everyone in the population has an equal chance of being chosen in which every driver in the United States had an equal chance of being included in the sample. What about the psychological studies being conducted by the professors and graduate students at your own university? In most instances, as much as they might like to randomly sample the entire population, budget limits and other practical considerations lead them to study those people who volunteer for their studies.

Beyond sample selection, how might you employ the scientific method to understand the personalities of your research participants? Often, psychologists use well-established, highly structured questionnaires in their research. For example, in my study of religious cult members (see Chapter 1), instead of simply asking these people questions that I thought of at the moment, I asked them all to respond to the same set of questions that other researchers had previously developed to measure specific aspects of personality. I then compared their responses to one another, as well as to those of other young adults who were not cult members, using a series of statistical computations. These statistical analyses allowed me to determine whether these groups differed from one another and how.

From this brief description of scientific methodology, you can see that the guidelines psychologists follow when conducting research are far more stringent than those typically employed in everyday thinking. Psychologists also approach the study of the mind by engaging in **critical thinking**, which is the process of deciding what to believe and how to act based on a careful evaluation of the evidence. An important aspect of critical thinking is ruling out alternative explanations. Can a hypnotized person be induced to commit murder? Is there compelling evidence that psychics can predict future events? Can subliminal tapes improve memory and increase self-esteem? These are a few of the fascinating questions we will examine in our journey of discovery, and we will do so while using critical thinking skills. The "Psychological Applications" section at the end of this chapter discusses how you can develop critical thinking skills to aid you in your journey. In the meantime, let's examine the research *process* itself and then scrutinize more thoroughly the *structure* of the various scientific methods psychologists use in their research.

Critical thinking The process of deciding what to believe and how to act based on careful evaluation of the evidence

Since the beginning of the twentieth century, people's innate desire to understand themselves—and the human condition—has found a new avenue toward the answer: the scientific method.

—Jacqueline Swartz, contemporary Canadian journalist

REVIEW

- Commonsense thinking often consists of the following faulty belief systems that can produce distorted judgments:
 - The primacy effect is the tendency for the first bits of information we learn to carry more weight in forming an overall impression than information learned later.
 - Implicit personality theories are the assumptions people make about which personality traits go together.
 - Hindsight bias is the tendency, once an event has occurred, to overestimate our ability to have foreseen the outcome.
- To minimize these human biases when conducting research, psychologists employ scientific methods.

2.2 What Is the Process in Conducting Research?



- * What are the stages in the research process?
- What is a theory, and how is it related to a hypothesis?
- What is the role of internal review boards in psychological research?
- How do psychologists analyze the findings across many studies?
- * Are there any "final truths" in science?

When you were a child, did you ever try building something that came with a set of plans? I remember making my first model airplane and being so excited about getting it to look like the image on the box that I ignored the directions and simply slapped the pieces together as fast as my little fingers would allow. Of course, employing such a slapdash method did not lead to a very pleasing final result. Through such experiences, I gradually learned the value of designing a plan of action when undertaking projects. This basic lesson is what the rest of this chapter is about. That is, in order for psychologists to effectively study the mind and behavior, they must employ scientific methods to carefully plan and execute their research projects. This process occurs in a series of four sequential stages, which are summarized in Figure 2-2. Let's examine each in turn.

2.2a The First Stage Involves Selecting a Topic and Reviewing Past Research.

In most instances, the research process begins by selecting a topic worth exploring. Scientists get their ideas from many sources. Inspiration could come from someone else's research, from an incident in the daily news, or from some personal experience in the researcher's life. Psychologists generally investigate topics that have relevance to their own lives and culture. For example, in 1964, people were stunned to learn of the brutal murder of a woman outside her New York City apartment building. The victim, Kitty Genovese, was attacked by her assailant over a period of 45 minutes. News reports described neighbors ignoring Ms. Genovese's cries for help during the attack. Based on this tragic incident, two social psychologists, John Darley and Bibb Latané (1968), decided to study the reactions of bystanders to potential emergencies. Their subsequent research provided valuable insights into the many factors that shape people's thinking when they witness an event that may be an emergency (see Chapter 16, Section 16.4e). Had this murder not received such widespread coverage, perhaps Darley and Latané would have directed their research activities in a different direction.

Once a topic has been selected, investigators search the scientific literature to determine whether prior investigations of the topic exist. The findings from these previous studies generally shape the course of the current investigation. Today, psychologists can vastly accelerate literature searches by using a number of computer-based programs that catalog even the most recently published studies. In addition, psychologists can often instantly obtain unpublished articles from researchers at other universities through computer networks.

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FIGURE 2-2

Stages in the Psychological Research Process

Stage 1: Selecting a Topic and Searching the Literature

Ideas come from a variety of sources, including existing theories, past research, current social events, and personal experiences. Once a topic has been selected, psychologists must not only become knowledgeable about past research findings in their area of interest, but also keep abreast of recently published studies and those reported at scientific meetings.



Stage 2: Developing a Theory and Formulating Hypotheses

Once the research literature has been digested, a theory is formulated and hypotheses that can be empirically tested must then be developed.



Stage 3: Selecting a Scientific Method and Submitting the Study for Ethical Evaluation

Research can be conducted in the laboratory or in the field, and the psychologist can employ a variety of methods, including correlational, experimental, and case study. All institutions seeking federal research funding must establish institutional review boards to evaluate the potential benefits and risks of proposed studies.



Stage 4: Collecting and Analyzing Data and Reporting Results

The three basic techniques of data collection are self-reports, direct observations, and archival information. Data can be analyzed using either descriptive or inferential statistics, with the latter mathematical analysis being the more valuable because it allows researchers to generalize their findings to the population of interest. Psychologists principally report their results at professional meetings and by publishing articles in scientific journals.

Often it is impossible to separate a literature search from topic selection because researchers may not choose a specific topic until they have extensively searched the available literature. In addition, keeping abreast of other colleagues' discoveries and insights is necessary during all stages in the research process. For this reason, searching the research literature may be thought of as a never-ending endeavor.

2.2b The Second Stage Involves Developing a Theory and Hypotheses.

The basic motivation underlying research is the desire to find answers to questions. The question of interest usually revolves around whether some event can be explained by a particular theory. A **theory** is an organized system of ideas that seeks to explain why two or more events are related. Put simply, a theory provides a picture of reality concerning some phenomenon. This picture develops after extensive observation, analysis, and creative reflection. Theory development, or at least theory testing, is an important aspect of the second stage of the research process. What makes a good theory depends on a number of factors, some of which are listed in Table 2-1 (Higgins, 2004).

The most salient factor in determining the value of a theory is its *predictive accuracy*. In other words, can it reliably predict behavior? A second necessary factor is *internal coherence*; that is, there shouldn't be any logical inconsistencies or unexplained coincidences among the theoretical principles and concepts. A third characteristic of a good theory is that it should be *economical*, meaning that it includes

Theory An organized system of ideas that seeks to explain why two or more events are related

TABLE 2-1 What Makes a Good Theory?

Predictive accuracy—Can the theory reliably predict behavior?

Internal coherence—Are there logical inconsistencies between any of the theoretical ideas?

Economy—Does the theory contain only what is necessary to explain the phenomenon in question?

Fertility—Does the theory generate research, and can it be used to explain a wide variety of behaviors?

the minimum number of principles or concepts necessary to adequately explain and predict the phenomenon in question. Finally, a fourth and equally important quality in a good theory is *fertility*, the ability to generate sufficient interest in other scientists so that the theory is tested and extended to a wide variety of behaviors.

Scientists determine the predictive accuracy of a theory by formulating hypotheses. A **hypothesis** is an educated guess or prediction about the nature of things based upon a theory—it is the logical implication of the theory. The researcher asks, "If the theory is true, what observations would we expect to make in our investigation?" An example of a hypothesis developing from a theory is William Dement's interest in dreaming. Following other researchers' discovery that dreaming was associated with periods of rapid eye movement (REM) sleep (Aserinsky & Kleitman, 1953), Dement (1960) developed a theory that dreaming was a fundamental requirement for all humans. He hypothesized that if people were not allowed to dream over a series of nights (by waking them when they entered REM sleep), they would experience some kind of pressure to increase their "dream time" on subsequent nights. This hypothesis was a logical extension of Dement's theory that there is something basic in our need to dream. (Refer to Chapter 6, Section 6.2d, for the results of Dement's research.)

After collecting data to determine whether the hypothesis successfully predicts the outcome of the study, researchers reevaluate the theory. Was the research hypothesis supported by the data, which thereby support the validity of the theory? If the data do not support the study's hypothesis, the theory probably needs revising. Figure 2-3 illustrates the cyclical nature of the relationship between a theory and a testable hypothesis.

2.2c The Third Stage Involves Selecting a Scientific Method and Obtaining IRB Approval.

When a theory and hypotheses have been developed, researchers must next select a scientific method that allows the hypotheses to be tested. Psychological research generally occurs in one of two settings—the *laboratory* (a controlled environment) or the *field* (a natural setting). Most laboratory research uses experimental methods, while most field studies are either *correlational* or *observational* (see Section 2.3).

In all scientific methods, psychologists seek to determine the nature of the relationship between two or more factors, called **variables** because they are things that can be measured and that are capable of changing. When scientists describe their variables, they do so by using *operational definitions*. An **operational definition** is a very clear description of how a variable in a study has been measured.

Why is an operational definition of a variable so important in scientific research? Consider how experimental psychologists often study hunger. When conducting this

Hypothesis An educated guess or prediction about the nature of things based upon a theory

One of the most serious problems confronting psychology is that of connecting itself with life. ... Theory that does not someway affect life has no value.

—Lewis Terman, U.S. psychologist, 1877–1959

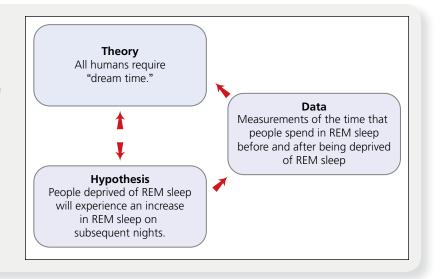
Variables In scientific research, factors that can be measured and that can vary

Operational definition A scientist's precise description of how a variable has been quantified so that it can be measured

FIGURE 2-3

The Theory-Hypothesis Relationship

There is a cyclical relationship between a theory and a hypothesis, with the data from a research study providing the evidence to support or reject the hypothesis. If the hypothesis is supported, the validity of the theory is also supported, generating new hypotheses to test in future research. If the research hypothesis is not supported, the validity of the theory is questioned, prompting a revision of the theory. From the revised theory, new hypotheses are developed that are then tested in another round of studies.



Replication Repeating a previous study's scientific procedures using different participants in an attempt to duplicate the findings

research, they frequently use specialized instruments that measure stomach contractions because such contractions signal the brain's lateral hypothalamic feeding system. In such studies, their operational definition of hunger is the onset of stomach contractions. This precise and concrete definition of hunger provides other psychologists with the necessary information concerning what was measured in the study, and it also allows them to repeat the same scientific procedures in future studies. Repeating a previous study's scientific procedures using different participants in an attempt to duplicate the findings is known as **replication**. Replication is important in advancing scientific knowledge because the findings from a single study are far less convincing than the same findings from a series of related studies. More on this is discussed later in Section 2.2e.

IRB Review of Human Studies

To ensure the health and safety of participants in psychological studies, all research-oriented institutions have *institutional review boards* (*IRBs*) to monitor and evaluate research proposals involving both human and animal subjects (Fisher & Vacanti-Shova, 2012). IRBs consist of a panel of both scientists and nonscientists who ensure the protection and welfare of research participants by formally reviewing the methodologies and procedures of proposed studies. Prior to conducting research, psychologists—like all other behavioral scientists—must have their proposed studies reviewed and approved by IRBs.

The issue of protecting research participants first became a hot topic of discussion in the psychological community during the 1960s following Stanley Milgram's (1963; 1974) obedience experiments, in which volunteers agreed to act as teachers in a learning experiment that, in actuality, was a study of obedience. In this experiment, the volunteers were ordered to deliver seemingly painful electrical shocks to a person because he wasn't performing well on a memory task. Although no shocks were ever delivered—the victim was an accomplice of Milgram and only pretended to be in pain—the stress experienced by the participants was real. The question raised by this study was whether the importance of the research justified exposing participants to potentially harmful psychological consequences.

The potential psychological harm in such research could take many forms. First, because studies like the obedience experiments provide false information to participants regarding their true purpose, such *deception* could lead to a loss of trust

in social scientists. Second, and more important, placing participants in situations where they are encouraged, or even coerced, to engage in antisocial activity could harm their mental health. That is, realizing that one has the potential for cruel behavior may induce feelings of guilt or inferiority in some people.

Spurred by the debate surrounding these controversial studies, the American Psychological Association developed detailed guidelines on the conduct of research with both human and nonhuman participants. To guard against harm to human participants, the guidelines followed by IRBs focus on the *risk/benefit ratio*, which weighs the potential risks to those participating in a study against the benefits that the study may have for advancing knowledge about humanity (Hayes, 2002; Rice, 2011). In assessing proposed studies, priority is always given to the welfare of the participants over any potential benefits of the research. With such standards and monitoring agencies in place, human psychological research is a very low-risk activity; participants usually enjoy their experience, even if they were initially deceived about the study's true purpose. Table 2-2 lists some of the guidelines followed when conducting research involving human participants.



Journey of Discovery

Imagine that you are a member of an institutional review board, and a research proposal similar to the Milgram obedience study has been submitted for approval. How would you determine its risk/benefit ratio?

IRB Review of Animal Studies

About 5% of all research published in psychology journals uses animals as subjects (Kiple & Ornelas, 2001). The vast majority of these studies involve little more than slightly modifying the environments of animals and observing how these changes affect their behavior. A minority of studies, however, involves painful and dangerous

TABLE 2-2 Guidelines for Conducting Research with Human Participants

In assessing proposed studies involving human subjects, priority is always given to ensuring their welfare over any potential benefits of the research (Saks et al., 2002; Street & Luoma, 2002). The guidelines also urge researchers to do the following:

- 1. Provide enough information to possible participants about the activities they will perform in the study so that they can freely give their informed consent.
- 2. Be truthful whenever possible. Deception should be used only when absolutely necessary and when adequate debriefing is provided.
- 3. Allow participants the right to decline to be a part of the study and the right to discontinue their participation at any point without this decision resulting in any negative consequences (for example, not receiving full payment for their participation).
- 4. Protect participants from both physical and psychological harm. If participants suffer any undesirable consequences, the researcher must do as much as possible to remove the damaging effects.
- 5. Ensure that any information provided by individual participants is kept confidential.
- 6. Debrief individuals once they have completed their participation. Explain all aspects of the research, attempt to answer all questions and resolve any negative feelings, and make sure they realize that their participation contributes to better scientific understanding.

BVT Lab

Flashcards are available for this chapter at **www.BVTLab.com**.

experimental procedures that would never be attempted on human participants. For example, research investigating the effect of drugs on brain function or the treatment of brain disorders and brain damage often begins with animal studies. This research has helped explain the causes of human mental illness and facilitated the development of effective treatments. Animal research has also contributed greatly to explanations of how the brain works, as well as to the discovery of basic principles of perception, motivation, and learning (Swanson, 2004).

Do such benefits outweigh the costs in terms of the harm done to the animal subjects in these studies? Many animal rights activists do not think so, and they have strenuously opposed such research, regardless of the resulting benefits (Bateson, 2011). Moderates among animal rights activists recognize the need for some of this research, but they argue that other research inflicts needless pain and suffering on animals. Within the field of psychology itself, although the majority of PhDs and psychology majors support animal studies involving observation or confinement, most disapprove of studies involving pain or death (Plous, 1996).

In response to such criticism, virtually all scientists who conduct animal research support the humane treatment of animals, but they deny that animals have the same rights as people. Instead, they contend that every advance in science must eventually be tried on a living creature. If animals are not substituted for humans in studies that pose significant health risks, then we must either (1) place human participants at serious risk in these studies, or (2) simply abandon the research altogether. Because neither of these options is acceptable to most people, animal research continues, as does the debate (Tulloch, 2011). However, responding to the widespread concern for the humane treatment of animals, both the American Psychological Association and a federal law known as the Animal Welfare Act have established standards for the humane care and treatment of laboratory animals. The U.S. Public Health Service also requires that all colleges and institutions receiving research grants from the National Institutes of Health maintain internal review boards to ensure that

- 1. animals are properly cared for;
- 2. subjecting animals to painful or stressful procedures is used only when an alternative procedure is unavailable;
- 3. surgical procedures are performed under appropriate anesthesia, and techniques to avoid infection and minimize pain are followed; and
- when an animal's life must be terminated, it is done rapidly, with an effort to minimize pain.

Table 2-3 lists some myths and facts about animal research.



Journey of Discovery

For every dog or cat used in a laboratory experiment, 10,000 dogs and cats are abandoned by their owners (Miller, 1985). When these abandoned animals are brought to local humane societies and not adopted, should they be made available as subjects for scientific research? Upon what values would you base your decision?

TABLE 2-3 Some Myths and Facts About Animal Research

Myth: Most animal research is unnecessary.

Fact: This may have been partly true 30 years ago when, for example, psychology students regularly used laboratory rats in their courses to better understand well-documented principles of learning. Today, however, strong economic pressures weigh against the unnecessary use of animals in research. The extremely limited funds available to conduct animal research minimize the possibility that animals will be used for such trivial purposes.

Myth: Other research methods can be used so that animals are not needed in behavioral research.

Fact: In most cases, no good alternatives exist. For example, computerized models of complex behavior still do not truly mimic actual behavior.

Myth: Most research animals are dogs, cats, and nonhuman primates.

Fact: Dogs and cats account for less than 1% of the total number of animal subjects. The same is true of nonhuman primates. Nearly 90% of the animals used in research are rats, mice, and other rodents.

Myth: Most animals in research suffer great pain and distress.

Fact: The vast majority of behavioral and biomedical research (over 90%) does not cause pain or significant distress to the animal. In only 6% of experiments are anesthesia or painkillers withheld. In such instances, researchers withhold pain relief because it would interfere with the objectives of the research (for example, studying the effects of pain).

Myth: Animal research benefits only humans.

Fact: Animal research benefits both humans and animals. For example, knowledge of animal sexual and feeding behavior has helped save a number of species from extinction. Further, insights gained through animal research on taste aversion have been used by both ranchers and conservationists to condition animal predators in the wild to avoid killing livestock and endangered species (see Chapter 7, Section 7.1d).

2.2d The Fourth Stage Involves Collecting and Analyzing Data and Reporting Results.

When approval has been granted by the IRB, it is time to *collect the data*. There are three basic techniques of data collection: (1) *self-reports*, (2) *direct observations*, and (3) *archival information*. Collecting data using self-reports allows researchers to measure important subjective states, such as people's perceptions, emotions, or attitudes. The disadvantage of self-report data, however, is that it relies on people accurately describing these internal states—something they are not always willing or able to do (Greenwald et al., 1998). Because of this drawback, many researchers prefer to directly observe people's behavior, recording its quantity and direction of change over time. Finally, researchers sometimes examine existing documents, or archives, to gather information. These accumulated records come from a wide variety of sources (for example, census information, court records, newspaper articles, magazines) and can provide researchers with a great deal of valuable information.

Once the data have been collected, the researcher must analyze it. In contemporary psychology, data analysis generally requires extensive knowledge of statistical procedures and computer software packages. Statistics is a branch of mathematics concerned with describing and drawing meaningful conclusions from collected data. *Statistical analysis* is very important because it provides scientists with information to judge whether they should accept or reject their research hypotheses.

Descriptive statistics

Numbers that summarize and describe the behavior or characteristics of a particular sample of participants in a study

Inferential statistics

Mathematical analyses that are used to determine whether the data support or do not support the research hypothesis

When conducting research, psychologists use two basic kinds of statistics: descriptive and inferential. **Descriptive statistics** are numbers that summarize and describe the behavior or characteristics of a particular sample of participants in a study. In contrast, **inferential statistics** are mathematical analyses that are used to determine whether the data support or do not support the research hypothesis. The difference between inferential and descriptive statistics is that inferential statistics move beyond simply describing the data obtained from the research sample to making inferences about the larger population from which the sample was drawn.

Psychologists use inferential statistics to estimate the likelihood that a difference found in the research sample would also be found if everyone in the population participated in the study. Is the difference found in the sample due to chance, or does it likely reflect actual differences in the larger population? Psychologists generally accept a difference as *statistically significant* if the likelihood of it having occurred by chance is less than 1 in 20—that is, a probability of less than 5% (Nickerson, 2000). Because one of the main objectives of psychological research is to generalize research findings to the population of interest, inferential statistics are the more valued type of statistic. For a closer examination of how psychologists employ statistics in their research, see Appendix A on "Statistical Reasoning" at the end of the text.

Finally, in any scholarly pursuit, for advancements to be made, researchers must share their knowledge with others in the field. Thus, the final task in the fourth stage of the research process is to *report results*. Psychologists principally share their findings by making presentations at professional meetings and by publishing articles in scientific journals. As they inform fellow scholars of their discoveries, researchers build upon and refine one another's work, and the understanding of psychology is enriched. This final task is very important for the advancement of the discipline. Yet psychologists' research findings are not uncritically accepted by others. At scientific conventions, where research is often first reported, and in scientific journals, where studies are ultimately published, all stages in the research process are scrutinized for possible errors and oversights. In most cases, a scientific journal will not publish research findings when there are significant problems with the hypotheses, methods, or data analysis. In addition, articles are often rejected for publication because reviewers decide the research isn't very important. Through such critical analysis, psychological knowledge is advanced.

Throughout this text, you will see citations like the following: (Hall & Brannick, 2002; Rice, 2011). These citations identify the authors whose research and ideas are being discussed, along with the year in which the cited book or scientific journal article was published. In the References section at the end of this text, you will find the complete references for this work, listed in alphabetical order by the first author's last name (in our examples, "Hall" and "Rice").

2.2e Meta-Analysis Statistically Summarizes the Findings Across Many Studies.

One of the problems in scientific research is that of having contradictory findings from one study to the next. For example, if eight studies find that one type of psychotherapy is effective in treating depression while five studies find that it is ineffective, what conclusions should be drawn? In the past, researchers often used the "majority rules" approach to resolve such controversies. That is, they merely counted up the number of studies that found or did not find a particular psychological effect and then concluded that the effect existed if it occurred in the majority

of studies. However, to better assess the findings from numerous studies during the past 20 years, researchers have increasingly relied on a more sophisticated comparison procedure called meta-analysis. **Meta-analysis** is the use of statistical techniques to sum up a body of similar studies in order to objectively estimate the reliability and overall size of the effect (Card, 2012; Kastrin, 2008). Because many studies may find small differences between groups that do not reach statistical levels of significance, meta-analysis can determine whether these small effects are, indeed, real or merely measurement error.

One area of research in which meta-analysis has proven invaluable is the study of gender differences. Meta-analytic techniques have found that the less sophisticated methodology of the majority rules approach often overestimated male-female differences. Even when meta-analytic studies did find gender differences (for example, greater verbal abilities in females and greater mathematical performance for males), the sizes of these differences were often so small as to be of little practical significance (Hyde et al., 1990; Stumpf & Stanley, 1998). Although meta-analytic studies have found that men and women do differ somewhat in their psychological functioning and social behavior, equally important is the finding that even when gender differences are found, far more differences exist between men and between women (within-sex variation) than between men and women (between-sex variation).

2.2f There Are No "Final Truths" in Science.

In the United States, an increasing number of school boards are in the grip of a controversy concerning whether creation science should be taught in science classes as an alternative explanation to evolutionary theory. The core of this argument involves what qualifies as a scientific theory; when making their case, local, state, and national politicians who advocate for creation science often reveal their ignorance of basic scientific principles. Advocates of creation science (sometimes referred to as creationism or intelligent design) reject evolution and adhere to a Bible-based explanation of God creating the world in 7 days (Evans, 2001). Some followers of creation science proclaim a more literal interpretation of the Bible's creation story than do others. Young Earth creationists believe in the book of Genesis's literal 7-day creation story, while old Earth creationists believe that the 7 days should be interpreted as figurative length of time. Whatever their differences concerning how much time passed while God created life, all creationists assert that their explanation is at least as scientifically based as evolutionary theory. My purpose here is not to judge the validity of the Bible's creation story. Instead, I would like to pose the following question: Based on your understanding of the scientific method, does creation science have a legitimate claim to be referred to as a scientific theory?

Let's review what constitutes a scientific theory. A theory is an organized system of ideas that seeks to explain why two or more events are related. To qualify as a theory, an explanation must be testable by the methods of science. The explanation must also be *falsifiable*, meaning that it must be possible to find fault with, or disconfirm, the explanation. If no one can think of a test that would falsify an explanation, then the explanation is not a scientific theory—even if it is true. "God exists" is a statement that cannot be tested because there is no conceivable experiment or observation that would falsify it. Belief in God's existence is a matter of faith, not science. Likewise, the statement "God created life" is not falsifiable. Therefore, creationism does not qualify as a scientific theory (Perakh, 2004). In 1987, the U.S. Supreme Court agreed with this assessment and ruled that creationism is religion, not science, and cannot be advocated as a scientific theory in public school classrooms (*Edwards v. Aguillard*).

Meta-analysis The use of statistical techniques to sum up a body of similar studies in order to objectively estimate the reliability and overall size of the effect



Visit www.BVTLab.com to explore the student resources available for this chapter.

As already noted, creationism stands sharply opposed to evolutionary theory. Why does the theory of evolution qualify as a scientific theory? The simple answer is that this theory is falsifiable. Tests can determine whether or not evolutionary theory is correct as it currently stands (actually, there is more than one theory of evolution), and these tests can be carried out. Current and past evolutionary theories have all been subjected to these tests, and the general principles of evolutionary theory have been repeatedly supported. Based on this wealth of evidence, virtually all scientists express strong confidence in the overall theory. Likewise, many religious organizations have concluded that evolutionary theory is not inconsistent with descriptions of creation and the origin of the human species. Many members of these religious organizations could be classified as theistic evolutionists: They believe that evolution is an accurate explanation of how organisms change over time, but they also believe in a God who is both personal and concerned about his (or her) creation (which is different from a Deist God who isn't concerned). Their first belief rests on the findings of science while their second belief rests on their religious faith, which is beyond the bounds of science.

The vast majority of people in the U.S., including many scientists, believe that God created the universe and life on this planet (Deckman, 2002). This belief in theistic evolution does not necessarily contradict or otherwise stand in opposition to scientific explanations of evolution. Perhaps one way to approach science and religion is in the following manner, suggested by the Roman Catholic Pope, Pius X:

... science is entirely concerned with the reality of phenomena, into which faith does not enter at all; faith on the contrary concerns itself with the divine reality which is entirely unknown to science. ... there can never be any dissension between faith and science, for if each keeps on its own ground they can never meet and therefore never be in contradiction. (Pius X, Roman Catholic Pope, 1835–1914)

In summary, it is important to understand that truth in science is never final. Scientific theories are explanations of how things in the world are related to one another and how they operate. They are logically constructed and reconfigured from careful observations and testable hypotheses. You can have such overwhelming data supporting your theory that you have very strong confidence that it accurately explains the phenomena in question; however, at the core of the scientific journey of discovery is the assumption that any theory can be modified or completely discarded tomorrow. Thus, if you seek to understand the human mind using the scientific method, it is a mistake to believe that any theory can achieve a "final truth."



- The process of scientific inquiry occurs in stages.
 - Stage 1 involves selecting a topic and searching the research literature.
 - Stage 2 involves developing a theory and hypotheses.
 - Stage 3 involves selecting a scientific method and submitting a proposed study for ethical evaluation.
 - Stage 4 involves collecting and analyzing data and reporting results.

- A theory's value is determined by its predictive accuracy, internal coherence, economy, and fertility; a hypothesis is derived from a theory.
- Institutional review boards weigh potential risks to participants against the study's benefits for advancing knowledge.
- Meta-analysis statistically summarizes the findings of many studies and estimates the reliability and overall size of the effects.
- A basic assumption in science is that any theory can be modified or completely discarded in light of new evidence.

2.3 Commonly Used Scientific Methods



- * What is observational research?
- * What is correlational research?
- **❖** What is experimental research?

One of the most important factors in determining whether a study will ultimately add to our knowledge of psychology is the method used to collect the data. Let us now examine the most commonly used scientific methods employed by psychologists, including their primary goals, as well as their strengths and weaknesses. One method seeks to describe behavior, another method seeks to understand the relationship between two or more variables, and the third method seeks to explain the causes of behavior.

2.3a Description Is the Goal of Observational Research.

To understand behavior so that it can be predicted and controlled, a psychologist must first describe it accurately. Scientific methods that have description as their primary goal fall under the category of observational research (Rustin, 2011). Within this category are the methods of naturalistic observation, participant observation, and case study.

You can observe a lot by watching.

—Yogi Berra, U.S. baseball player and manager, 1925–2015

Naturalistic Observation

Naturalistic observation is a scientific method that describes how people or animals behave in their natural environment (Crabtree & Miller, 1992; Schnicker et al., 2011). Settings for such research range from day-care centers, where developmental psychologists might record the play behavior of children, to the jungles of Africa, where comparative psychologists might study how a troop of baboons defends itself against predators. In all such naturalistic studies, behavior is merely observed and recorded—it is not manipulated. Besides employing naturalistic observation as a primary scientific method, other researchers use it during the initial stages of a project to generate research ideas and gather descriptive data.

One example of a naturalistic observation study is Robert Levine and Ara Norenzayan's (1999) analysis of the pace of everyday life in 31 cultures around the world. The researchers were interested in determining whether people in different cultures operated at a different pace in carrying out their daily activities. Examples of some of the data they collected were measurements of people's average walking speed on city sidewalks, the speed at which postal clerks responded to a simple request, and the accuracy of clocks in public settings. Notice that all these measurements simply



Naturalistic observation involves studying behavior in its natural environment, such as the daily behavior of residents in an urban setting. What are some advantages of this research method?

Participant observation A descriptive scientific method in which a group is studied from within by a researcher who records behavior as it occurs in its usual natural environment

Every journey into the past

is complicated by delusions, false memories, false

namings of real events.

—Adrienne Rich, U.S. poet, 1929–2012

Case study A descriptive scientific method involving in-depth analysis of a single subject, usually a person

involved the researchers observing how people behaved in their natural surroundings. Their findings indicated that the pace of life was faster in colder and more economically productive cultures (such as Switzerland, Germany, and Japan) than in those that were hotter and less economically energetic (such as Mexico, Indonesia, and Brazil).

Participant Observation

Another type of observational method is **participant observation**. Here, as in naturalistic observation, a researcher records behavior as it occurs in its natural environment but does so as a participant in the group being studied. One of the chief benefits of this research strategy is that it allows investigators to get closer to what they are studying than does any other method.

An excellent example of this method is Leon Festinger's study of a Chicago-based doomsday cult in the 1950s (Festinger et al., 1956). The leader of the cult, Mrs. Keech, claimed that aliens from outer space had told her the world would come to an end on a specific date, December 21. She also stated that the only survivors of this catastrophe would be members of her group. When Festinger and his coworkers learned of Mrs. Keech, they became interested in measuring the psychological changes that would occur within the group when the doomsday came and passed with the world still intact. To accomplish this task, over a period of several weeks, these researchers infiltrated the group as participant observers and began describing its dynamics. This descriptive study was one of the first tests of a new theory in psychology called *cognitive dissonance theory* (see Chapter 16, Section 16.2c).

The following are four advantages of both naturalistic and participant observation research (Hong & Duff, 2002; Weick, 1985):

- 1. Researchers are able to watch behavior in its "wholeness," providing the full context in which to understand it.
- 2. Researchers are able to record rare events that may never occur in a controlled laboratory environment.
- 3. Researchers are able to systematically record events previously observed only by nonscientists.
- 4. Researchers are able to observe events too risky, dangerous, or unethical to create in the laboratory.

Despite these benefits, there are also problems in using naturalistic and participant observation methods. First, because of the researchers' lack of control in such studies, conclusions must be drawn very carefully. Second, researchers must be mindful that their participation in or even their observation of events can significantly alter the participants' behavior, and thus taint the data. Although researchers assume that after a period of time those who are being observed become accustomed to their presence, it is difficult to evaluate to what degree this actually occurs. Finally, more than any other scientific method, observational methods pose the most ethical problems involving invasion of others' privacy.

Case Study

Another form of observational research is a **case study**, which involves in-depth analysis of a single subject, usually a person (Simons, 2014). This method of inquiry is common in

clinical work, in which psychotherapists provide an extensive description of a person suffering from a particular psychological disorder to illustrate the factors that lead to and influence it (Morgan & Morgan, 2001). Sigmund Freud's work is perhaps the most famous example of this method in psychology (Gedo, 2001). Like the other observational studies just discussed, the case study method is sometimes relied on by neuroscientists when investigating individuals with extraordinary cognitive abilities or significant brain damage (see opening stories in Chapters 3 and 8). In such cases, researchers hope that any insights gained by studying one person will inspire ideas for later experimental or correlational studies involving more people (Trepper, 1990).

The advantage of the case study is that it produces a more detailed analysis of a person than does any other method.



The case study method produces a more detailed analysis of a subject than does any other method, but what are two of its disadvantages?

One disadvantage is that researchers must be extremely cautious when generalizing from a single case to the population as a whole. Another problem is that this method often depends on research participants' memories of the past, which all too often are both selective and inaccurate (see Chapter 8, Section 8.3d).

2.3b Correlational Research Analyzes the Nature of the Relationship Between Variables.

Along with describing a phenomenon under study, often psychologists want to also know whether two or more variables are related and, if so, how strongly. When changes in one variable relate to changes in another variable, we say they *correlate*. **Correlational research** assesses the nature of the relationship between two or more variables that are not controlled by the researcher. The importance of correlational research for psychologists is *prediction*: It allows them to predict a change in one variable by knowing the value of another variable.

Using Surveys When Conducting Correlational Research

Although studying the relationships among variables can be done by directly observing behavior, it is often accomplished by asking people carefully constructed questions. A **survey** is a structured set of questions or statements given to a group of people to measure their attitudes, beliefs, values, or behaviors (Nestor & Schutt, 2012). The three major survey techniques are *face-to-face surveys*, *written surveys* (either in person or online), and *phone surveys*. The face-to-face format provides highly detailed information and allows researchers the best opportunity to clarify any unclear questions. However, it is costly, and there is always the possibility that people's responses might be influenced by the interviewer's presence. Written or online surveys and phone surveys eliminate such interviewer bias and are much less expensive (Ravert et al., 2015). Obtaining information using surveys is generally relatively easy, but its main disadvantage is that it relies on people's self-reports, which are often faulty (Holtgraves, 2004).

Surveys are often used to gather information on behavior or other psychological processes that are difficult, if not impossible, to observe directly. For example, imagine that you are a psychologist interested in learning the degree to which people pay attention to their private thoughts and feelings and the degree to which they disclose these private thoughts and feelings to others. You might ask them to complete a survey questionnaire similar to the one in Self-Discovery Questionnaire 2.1, which measures both the personality trait known as *private self-consciousness* and the behavioral

Correlational research

Research designed to examine the nature of the relationship between two or more naturally occurring variables

Survey A structured set of questions or statements given to a group of people to measure their attitudes, beliefs, values, or behaviors



How Do Psychologists Measure Self-Consciousness and Self-Disclosure Tendencies?

Measuring Private Self-Consciousness

The personality trait of private self-consciousness is measured by items on the Self-Consciousness Scale (SCS; Fenigstein et al., 1975). To obtain information on the degree to which you attend to your own private thoughts and feelings, read each item below. Then indicate how well each statement describes you, using the following response scale:

0 = extremely uncharacteristic (not at all like me)

- 1 = uncharacteristic (somewhat unlike me)
- 2 = neither characteristic nor uncharacteristic
- 3 = characteristic (somewhat like me)
- 4 = extremely characteristic (very much like me)

	I'm always trying to figure myself out.
 2.	Generally, I'm not very aware of myself.*
	I reflect about myself a lot.
4.	I'm often the subject of my own fantasies.
	I never scrutinize myself.*
6.	I'm generally attentive to my inner feelings.
7.	I'm constantly examining my motives.
8.	I sometimes have the feeling that I'm off
	somewhere watching myself.
9.	I'm alert to changes in my mood.
	I'm aware of the way my mind works when I
	work through a problem.

The two items with an asterisk (*) are reverse-scored; that is, for these items, a lower rating actually indicates a greater tendency to attend to private thoughts and feelings. Before summing the items, recode those with an asterisk so that 0=4, 1=3, 3=1, and 4=0. To calculate your private self-consciousness score, simply add up your responses to the 10 items. The average, or mean, score for college students on private self-consciousness is about 26. The higher your score is above this value, the greater is your tendency to reflect upon your private thoughts and feelings compared with the average U.S. college student. The lower your score is below this value, the less likely is your tendency to regularly engage in this sort of private self-awareness compared to other students.

Measuring the Tendency to Self-Disclose

Items on the Self-Disclosure Scale measure willingness to self-disclose (SDS; Miller et al., 1983). To obtain information on your self-disclosure tendencies, indicate the degree to which you have disclosed to a close romantic partner on the topics below, using the following scale:

0 = Discussed not at all	
1	
2	
2	

4 = Discussed fully and completely

 1.	My personal habits
2.	Things I have done that I feel guilty about
 3.	Things I wouldn't do in public
 4.	My deepest feelings
 5.	What I like and dislike about myself
 6.	What is important to me in life?
 7.	What makes me the person I am?

8. My worst fears

9. Things I have done that I am proud of

10. My close relationships with other people

Total Score

You can determine your overall self-disclosure score by adding up the scores in the column. The higher the score, the greater your willingness to self-disclose.

Sources: SCS: From "Public and Private Self-Consciousness: Assessment and Theory" by Allan Fenigstein, Michael F. Scheier, and Arnold H. Buss in Journal of Consulting and Clinical Psychology, 1975, 43, 522–527 (Table 1, p. 524). Copyright © 1975 by the American Psychological Association. Adapted with permission. SDS: From "Openers: Individuals Who Elicit Intimate Self-Disclosure" by L.C. Miller, J.H. Berg, and R.L. Archer in Journal of Personality and Social Psychology, 1983, 44, pp. 1234–1244 (Table 2, p. 1236). Copyright ©1983 by the American Psychological Association. Adapted with permission.

tendency to *self-disclose*. Before reading further, spend a few minutes answering the questions in the Self-Discovery Questionnaire, and compare your responses with those of other college students.

If you were using survey data only to determine how people compare on various personality and behavioral measures, your research would involve observational methods in which description is the primary goal. However, returning to our example, imagine

that you are interested in discovering whether there is a relationship between private self-consciousness and willingness to self-disclose. That is, do people who regularly attend to their private thoughts and feelings disclose this private side of themselves more than do those who do not habitually self-reflect? Now you are seeking information on whether these two variables are *correlated*. That is, can you predict whether people are likely to self-disclose based on their level of private self-consciousness, or vice versa? In correlational research, as in observational research, you would not try to influence how much time people in your study actually spent thinking about themselves. Instead, you would merely gather information on how often they attended to their own thoughts and feelings and the degree to which they self-disclosed to others.

The Correlation Coefficient

How does correlational research aid in prediction? It does so by providing the psychologist with information on the *direction* and *strength* of the relationship between two variables. The direction of the relationship between variable X and variable Y tells the researcher *how* they are related (positively or negatively). The strength of the relationship can be thought of as the degree of accuracy with which you can predict the value of one variable by knowing the value of the other variable. The direction and strength of the relationship between two variables is described by the statistical measure known as the **correlation coefficient** (r). The correlation coefficient can range from -1.00 to +1.00.

If you think of variable X as being people's degree of private self-consciousness and variable Y as being their degree of self-disclosure, a study with a correlation at or very near zero would indicate the absence of a *linear relationship* between these two variables. This zero correlation may mean one of two things: (1) Regularly self-reflecting has no association with self-disclosing, or (2) a *curvilinear relationship* exists between self-reflection and self-disclosing. You can easily determine the meaning of a zero correlation by plotting the pairing of these two variables on a scatterplot graph, as illustrated in Figure 2-4. When you plot the relationship between the two variables for each of your research participants, what does the scatterplot look like? Dots randomly scattered around the graph tell you that there is absolutely no relationship between self-reflecting and self-disclosing. However, when the plotted dots form a curved line like the one depicted in Figure 2-4, this indicates that people who self-reflect either very little or very much tend to self-disclose a lot, but those who are only moderately attentive to their private thoughts and feelings seldom self-disclose.

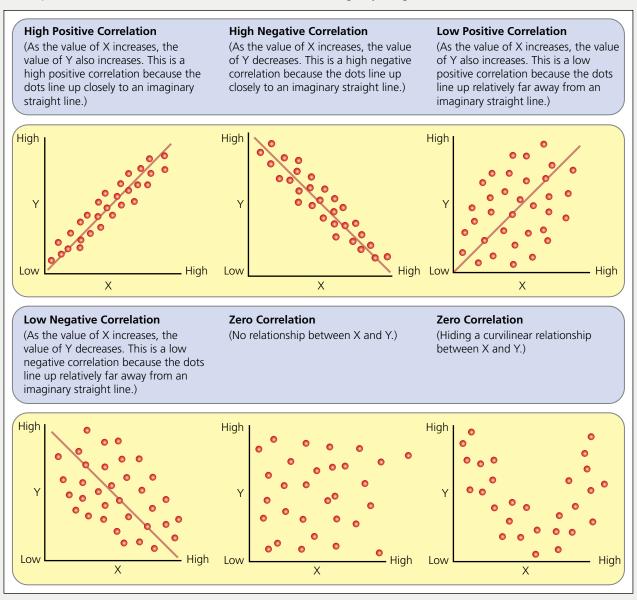
In marked contrast to a correlation at or very near zero, a correlation near +1.00 would have dots lining up on an imaginary straight line running between the X and Y axes of the graph. In our example, this would suggest that people who regularly attend to their private thoughts and feelings are much more likely to self-disclose than those who engage in little self-reflection. In contrast, a correlation near -1.00 would have a scatterplot with the dots lining up on an imaginary line in the opposite direction, indicating that people who regularly self-reflect are much less likely to self-disclose than are those who engage in little self-reflection.

Regarding the strength of a relationship, researchers seldom find a perfect or near perfect (r = +1.00 or r = -1.00) correlation between variables. For example, a study investigating the relationship between young adults' private self-consciousness and their degree of self-disclosure to their romantic partners found a correlation of .36 for men and a correlation of .20 for women (Franzoi et al., 1985). On a scatterplot, the dots would be farther away from the imaginary line running between the X and the Y axes. Because of the direction of the correlation, you might predict that men with a high level of private self-consciousness would be more likely to self-disclose to their romantic partners than men with a low level of private self-consciousness. For women, you would make the same prediction, but you would be less confident because of this correlation's lower strength.

Correlation coefficient (r) A statistical measure of the direction and strength of the linear relationship between two variables, which can range from -1.00 to +1.00

FIGURE 2-4 Plotting the Relationship Between Variable X and Variable Y on a Graph

The points on the graphs represent a pairing of variable X with variable Y for each participant in the study. As you can see in the curvilinear relationship graph, the zero correlation is hiding a meaningful relationship, where both high and low levels of X are associated with high levels of Y, but moderate levels of X are associated with low levels of Y. Can you think of variables that would have a curvilinear relationship? In addition to the direction of the relationship between variable X and variable Y, correlations can have different values. The greater the scatter of values on the graph, the lower the correlation. A perfect correlation occurs when all the values fall on an imaginary straight line.



Although these correlations might seem small, in social science research correlations rarely exceed .60. Correlations of about .50 are regarded as strong; those at about .30 are moderately strong; those at .15 or below are considered weak. The reason correlations rarely exceed .60 is that many variables determine human behavior. In the example of self-disclosing to someone, many variables influence people's degrees of self-disclosure. In addition to the disclosers' own levels of private self-consciousness, we must also consider their partners' willingness to listen and the closeness of the

relationship, as well as the amount of time they actually spend together. Furthermore, even if researchers could isolate all the important variables that influence self-disclosing, because of the nature of our subject—humans with minds of their own—it's unlikely they would be able to predict with perfect reliability people's actions.

The major disadvantage of the correlational study is that it cannot definitively determine the *cause* of the relationship between two variables. Besides knowing the strength and direction of a relationship, it is also extremely valuable to know which variable causes a change in the other. Does attending to their own thoughts and feelings make people more eager to self-disclose, or does self-disclosing make people more attentive to these thoughts and feelings? This methodological disadvantage can result in the *reverse causality problem*, which occurs whenever either of the two variables correlated with one another could just as plausibly cause the changes in the other (see Figure 2-5).

A second problem resulting from the inability to confidently determine causality is that a third, unmeasured variable can possibly cause changes in both variables under study. This is known as the *third-variable problem* (see Figure 2-4). In our previous example, it is possible that what looks like a positive correlation between private self-consciousness and self-disclosing is really an illusion because another variable—perhaps parental upbringing or inherited traits—is actually causing both of those changes.

The invalid assumption that correlation implies cause is probably among the two or three most serious and common errors of human reasoning.

—Stephen Jay Gould, *The Mismeasure of Man* (1981), p. 242

2.3c Experimental Research Determines Cause-Effect Relationships.

Because correlational studies cannot conclusively tell us *why* variables are related, psychologists conduct **experimental research** to examine cause-effect relationships (Nestor & Schutt, 2012). In an experiment, the psychologist manipulates one variable by exposing research participants to contrasting levels of it (for example, high, medium, low, or no exposure) and then observes what effect this manipulation has on the other variable, which has not been manipulated. The variable that is manipulated, which is called the **independent variable**, is the one the experimenter is testing as the possible *cause* of any changes that might occur in the other variable. The variable whose changes are considered the *effect* of the manipulated changes in the independent variable is called the **dependent variable**. Once participants have been exposed to the independent variable, their behavior is carefully monitored to determine whether it changes in the predicted fashion with different levels of the independent variable. If it does, the experimenter concludes that the independent variable is the cause of the changes in the dependent variable.

Experimental research

Research designed to test cause-effect relationships between variables

Independent variable The experimental variable that the researcher manipulates

Dependent variable The experimental variable that is measured because it is believed to depend on the manipulated changes in the independent variable

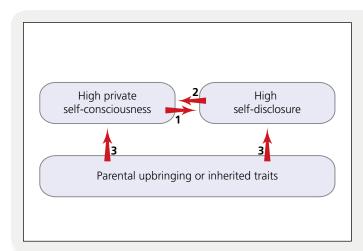


FIGURE 2-5 Difficulties in Distinguishing Causation from Correlation

People who are high in private self-consciousness (PSC) are more willing self-disclosers than those low in PSC. Thus, you might conclude that being high in PSC causes increased self-disclosing in people (arrow 1). However, an alternative explanation is that the act of regular self-disclosing causes an increase in people's level of PSC (arrow 2). What is this methodological problem of correlation interpretation called? Now look at arrow 3. What if parental upbringing or inherited genes were causing the changes in both PSC and self-disclosing? What sort of correlation problem would this example illustrate?

Random assignment

Placement of research participants into experimental conditions in a manner that guarantees that all have an equal chance of being exposed to each level of the independent variable

Experimental condition The condition in an experiment whereby participants are exposed to different levels of the independent variable

Control condition The condition in an experiment in which participants are not exposed to the independent variable

A key feature of most experiments is that participants are randomly assigned to the different levels of the independent variable. In such a **random assignment**, the experimenter, by some random procedure, decides which participants are exposed to which level of the independent variable. Because of this procedure, the experimenter can be reasonably confident that the participants in the different experimental conditions don't differ from one another.

Some of the better-known experiments in psychology are Albert Bandura's Bobo doll studies, in which he and his colleagues studied whether children would imitate the behavior of an aggressive adult (Bandura et al., 1961). In one of these experiments, a child was first brought into a room to work on an art project. In another part of the room, an adult who was a *confederate*—meaning that she was an accomplice of the experimenter—was playing quietly with some Tinker Toys. Near these toys were a mallet and a Bobo doll, which is a big, inflatable, clown-like toy weighted down so that when it is pushed or punched it will bounce back to an upright position. With half of the children in the study, the adult—after playing with the Tinker Toys for a minute—stood up, walked over to the Bobo doll, and began to attack it. She punched the doll, kicked it, hit it with the mallet, and even sat on it. As she pummeled the clown doll, she yelled out, "Sock him in the nose! ... Kick him! ... Knock him down!" With the other children, the adult simply played quietly and nonaggressively with her toys for 10 minutes.

In Bandura's study, the independent variable (remember, this is the variable that is manipulated) was the aggressiveness of the adult's play behavior. After witnessing either the aggressive or nonaggressive adult confederate, each child was led into another room filled with many interesting toys. However, before the child could play with them, the experimenter aroused frustration by saying that these were her best toys and she must "save them for the other children." The child was then led to a third room, containing both aggressive and nonaggressive toys, including a Bobo doll. What children did in this third room was the essential question of the study, for their level of aggressive play here was the dependent variable. The children who had observed the aggressive adult were in what is called the **experimental condition**, the condition of being exposed to different levels of the independent variable (in this case, the adult's aggression). In contrast, the children who had observed the nonaggressive adult were in what is called the control condition, the condition of not being exposed to the independent variable. Because the only difference between the experimental and control conditions in this study was whether or not the children had been exposed to an aggressive adult (the independent variable), any subsequent differences in the children's aggression (the dependent variable) could be attributed to the manipulation of the independent variable.

So what happened in the third room? Children in the control condition tended to play nonaggressively with the toys, whereas those in the experimental condition tended to beat up the Bobo doll, often shouting the same things at the clown that the aggressive adult had shouted. Based on this experiment and others like it, Bandura concluded that observing adult aggression could teach children to act more aggressively themselves. Figure 2-6 provides an overview of the elements in an experiment, using Bandura's study as an example.

The Bobo doll study represents a type of experiment called a *laboratory experiment*. Most psychology experiments are conducted in laboratories. The laboratory experiment can be contrasted with the less common *field experiment*, which is run in a natural setting, with participants often not realizing they are being studied. For example, a field experiment that also investigated how watching aggression might influence children's own aggressive behavior was conducted in a Belgian private institution for adolescent schoolboys by Jacques-Philippe Leyens and his colleagues (1975).

Hypothesis Children will imitate the behavior of an aggressive adult. Random Subjects are randomly assigned to experimental and **Assignment** control conditions. Manipulation Experimental condition: Control condition: of Independent Child observes an Child observes a **Variable** aggressive adult. nonaggressive adult. Measurement The experimental group later engaged in greater of Dependent aggressive behavior than did the control group. Variable Conclusion Observing an aggressive adult model increases the aggressive behavior of children.

FIGURE 2-6

The Basic Elements in an Experiment

As illustrated in the Bandura study, the power of experimental research is based on treating the experimental and control groups exactly alike except for the manipulation of the independent variable. Any later observed differences in the dependent variable between the two groups can then be confidently attributed to the effects of the independent variable.

The independent variable in this study was exposure to violent films. In two dormitories at the school, boys were shown a violent film every night for one week; during the same time period, the boys in two other dorms were shown the same number of nonviolent films. The experimenters then measured the children's aggressive behavior (the dependent variable) outside of the film-viewing settings and found that those in the experimental condition exhibited higher levels of aggression than did the control group. Based on these findings, they concluded that exposure to violent films can cause increased aggressiveness in viewers.

Although both laboratory and field experiments are valuable tools for research psychologists, each of these experimental methods has its own unique strengths and weaknesses (Nichols & Edlund, 2015). The main advantage of a lab experiment over a field experiment is that the variables can be well controlled. In Leyens's field study, for instance, he and his colleagues could not control all the interruptions and other distractions that may have occurred while they were attempting to test their hypotheses. However, the greater control in laboratory research often has a price: the danger of artificiality. Realism is the primary advantage of a field experiment. The research takes place in the participants' normal surroundings, and thus their responses are more natural and spontaneous.

Recently, some psychologists believe they have found a possible remedy to the dilemma of choosing between greater control and greater realism in their experiments (Schmelter et al., 2009). They recommend using *virtual environment technology* (*VET*), in which they create a virtual research environment using a computer. Once this simulated reality is created, research participants wearing virtual-reality equipment are "immersed" in the setting. A commonly used piece of virtual-reality equipment is a head-mounted or binocular-style device that allows an individual to view 3-D images and to "walk" through the virtual environment. Although this type of simulated environment is completely controlled by the experimenter—even more than the traditional laboratory setting—it has a very real-world feel to it, similar to that of a field experiment.

Studies employing virtual environment technology suggest that participants behave relatively naturally in such settings (Blascovich, 2002; Waller et al., 2002). Although still in its infancy, virtual environment technology is currently being used to study such topics as conformity, eyewitness testimony, effects of violent video games,

and simulated weightlessness. As this technology improves, psychologists hope to involve senses beyond sight and hearing, as well as to improve the ways people can interact with the virtual creations they encounter. This technology is not meant to replace traditional field and laboratory studies; instead, it is meant to provide another research vehicle that psychologists can use in their journey of discovery.



Journey of Discovery

What role should values play in science? Is it possible or desirable to separate values from science?



Based on more than 40 years of psychological studies, what do we know about the effects of television violence on people's aggressive tendencies? Should this scientific knowledge be used to influence social policy decisions? Will it influence how you raise your own children?

Now that you have learned about the different scientific methods that psychologists use, which is the best? Actually, what I hope you take from this overview is that there is no one best method in all research settings. In each investigation, the psychologist must decide what method would provide the best test of the hypotheses under consideration. The best overall strategy for psychologists is a *multimethod* approach—employing different scientific methods to study the same topic, thereby capitalizing on each method's strengths and controlling for its weaknesses.



- Some of the most commonly employed scientific methods in psychology are observational, correlational, and experimental designs.
- Observational research describes behavior as it occurs in its natural setting.
- Correlational research assesses the direction and strength of the relationship between two or more variables.
- Experimental research involves manipulating one or more independent variables to determine the effect on nonmanipulated dependent variables.



How Can You Develop Critical Thinking Skills?

In this chapter, you have become familiar with the science of psychology and the different research methods employed within the discipline. In this last section, I will discuss the kinds of critical thinking skills that not only are necessary in conducting scientific research but also are important in making you both a wise consumer of psychological knowledge and a capable decision maker in your own journey of discovery (Halonen, 1995; Stanovich, 1996).

What Is Critical Thinking?

On her 8th birthday, my oldest daughter, Amelia, faced a dilemma. She was in a toy store trying to decide which new bicycle to pick for her present. The colors, names, and styles of the bikes were clearly aimed at steering girls and boys toward different choices. Yet, Amelia ignored these gender labels and tested all the bikes. At the end of this process, she knew which bike felt the best riding-wise—the blue Huffy Hyper Force boy's bike. Amelia also knew, however, that if she picked a boy's bike, some of the neighborhood kids would tease her. She knew this because on her 5th birthday her choice had been a red Huffy Rough Rider. Three years later, Amelia realized she could avoid the same negative comments by picking her second choice, the pink Barbie Fashion Fun girl's bike.

All this she explained to me as we stood in the store scanning the array of possibilities before us. Perhaps she was hoping I would draw upon that mystical "father knows best" wisdom that I had sometimes alluded to, and simply tell her which bike to choose. Instead, I said, "Amelia, this is your decision. You have to decide whether you will pick the bike that rides the best or the bike that looks the best for girls, and thus, will be most acceptable to some of your friends. Think about what's most important to you." After carefully evaluating the evidence and weighing the possible consequences of her two choices, she picked the Hyper Force boy's bike.

This Amelia example illustrates an important type of problem-solving skill known as critical thinking. As defined in Section 2.1b, critical thinking is the process of deciding what to believe and how to act based on careful evaluation of the evidence. As you will learn more fully in Chapter 9, Sections 9.2d and 9.2e, as a species, we humans have the capacity to scrutinize available facts and arrive at judgments based on careful reasoning. Unfortunately, we often fail to use these cognitive skills and simply engage in "lazy thinking," instead, which often results in being misled and manipulated by other people and events. In picking a bike, Amelia could have uncritically followed the color schemes and bike styles that her culture designates for girls, but instead she decided that these gender labels unnecessarily restricted her choices. By challenging the assumption that a bike's color and style restrict who can ride it, Amelia could entertain many more bike possibilities. Once she had gathered her own information by riding all the bikes, she also could have ignored the evidence of her senses and chosen the gender-appropriate but less rider-worthy bike. Again, based on careful reflection of her options, she made her choice. That is one hallmark of critical thinking.

What if Amelia had decided, after going through this entire process, that the benefits of the better-riding boy's bike were not enough to justify the social hassles associated with it? Would the decision to pick the girl's bike have indicated a lack of critical thinking? The answer is no. The *choice* does not determine whether critical thinking took place. Rather, the *type* of cognitive process in which a person engages is the crucial point. We have learned that thinking critically about the arguments that you make to yourself, or that others make to you, can greatly improve your own decision-making (Anderson, 1992; McBride et al., 2002).

Guidelines for Critical Thinking

How often have you said to yourself or to someone else, "I don't want to think about how to solve this problem; I just want someone to tell me the answer"? Although being told how to think and act reduces cognitive effort, it certainly doesn't promote critical thinking. The following are some general guidelines on how to think critically:

- 1. Be willing to ask questions. Knowledge begins with questioning the nature of things. Think of the process of questioning as a sign of inquisitiveness, not a lack of intelligence.
- 2. Analyze assumptions. Instead of passively accepting assumptions as facts, think about possible exceptions and contradictions.
- 3. *Examine the evidence*. Instead of accepting a conclusion without evidence, ask for and analyze the evidence that supports and contradicts the various positions.
- 4. Be cautious of emotional decisions. Although there is certainly nothing wrong with being emotionally involved with a particular decision, avoid basing your decision on what you would *like* to be true, versus what you *know* to be true.



How Can You Develop Critical Thinking Skills? (Continued)

- 5. Avoid oversimplifying issues. It can be comforting to make simple generalizations about complex events, but resisting glib explanations provides the opportunity for creative complexity.
- 6. Tolerate ambiguity. By rejecting simple answers, you must learn to develop a tolerance for ambiguity. Don't be afraid to admit that you don't know the correct answer when the evidence suggests many possible solutions rather than a single correct one.

Critical thinking can be fostered through many activities, but the study of psychology is particularly helpful in promoting this type of cognitive activity (Haw, 2011). In fact, when researchers examined the reasoning ability of graduate students in psychology and chemistry, they found that as the two groups advanced through graduate school, the psychology students became better at analyzing everyday events while the chemistry students showed no improvement (Lehman et al., 1988). One of the likely reasons why psychology promotes critical thinking is that students of psychology learn a great deal about how the mind works, including the many biases and errors that are obstacles to

Either you think or else others have to think for you and take power from you.

—F. Scott Fitzgerald, U.S. author, 1896–1940

We do not live to think, but, on the contrary, we think in order that we may succeed in surviving.

—José Ortega y Gasset, Spanish philosopher, 1883–1955

intelligent thinking. In this instance, knowledge really is power. Hopefully, one of the benefits of taking this course is that your increased knowledge of how people think and behave will allow you to make more intelligent decisions in your everyday life.

Key Terms

Case study 46
Control condition 52
Correlational research 47
Correlation coefficient (r) 49
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Descriptive statistics 42
Experimental condition 52
Experimental research 51

Hindsight bias 32
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Variables 37

Suggested Websites

Critical Thinking Across the Curriculum Links

http://www.psychologicalscience.org/observer/on-critical-thinking#.WIVxPBRezFI

This Association for Psychological website contains an article by psychologist Jane Halonen on how students can use critical thinking in their psychology courses.

Animal Welfare Information Center

http://www.nal.usda.gov/awic/

This website provides information on the ethical treatment of animals in government-sponsored research programs.

Review Questions

- 1. Research on how young adults judge potential sex partners illustrates which of the following concepts?
 - a. the primacy effect
 - b. evaluative consistency
 - c. implicit personality theory
 - d. all of the above
 - e. b and c
- 2. What is the scientific method?
 - a. any set of techniques employed by scientists
 - b. one that is confined to studies in which a control group is compared to a treatment group
 - c. one used to prove that theories are true
 - a controversial set of procedures and continually shifting standards
 - e. a set of procedures to collect data that minimize errors
- 3. Which of the following statements is *true*?
 - a. Psychologists have developed special formulas to eliminate biases and errors in human judgment.
 - b. Statistical analysis is useful in generalizing findings from samples to the population.
 - c. Psychologists are immune to error-prone thinking.
 - d. It is not important that a sample represents the population.
 - e. Psychologists cannot make dependable generalizations.
- 4. Dement's claim that there is something basic in our need to dream would be considered a _____
 - a. hypothesis
 - b. theory
 - c. case study
 - d. correlational coefficient
 - e. topic selection

- 5. Which of the following is true of institutional review boards (IRBs)?
 - They monitor and evaluate research proposals involving only human subjects.
 - b. They focus on risk/benefit ratio.
 - c. They never allow participants to be deceived about a study's true purpose.
 - d. They claim that human psychological research is a high-risk activity.
 - e. a and b
- 6. What is the term for the precise descriptions of how factors in a study have been quantified and measured?
 - a. operational definitions
 - b. independent variables
 - c. descriptive statistics
 - d. hypotheses
 - e. theories
- 7. Which of the following statements is *true* of animal research?
 - a. Most animal research is unnecessary.
 - b. Other methods could be used so that animals are not needed in behavioral research.
 - c. Nearly 90% of animals used in research are
 - Ninety percent of behavioral and biomedical research causes pain and significant distress to animals.
 - e. Animals do not benefit from animal research.

- 8. Which of the following statements is *true*?
 - a. Descriptive statistics are a more valued type of statistic than inferential statistics.
 - A difference is considered statistically significant if the likelihood of its having occurred by mere chance is less than one in five.
 - c. Contemporary psychology does not require extensive knowledge of statistics.
 - Meta-analysis is the technique of counting the number of studies that find or do not find a particular effect.
 - e. Reporting results is an important stage of research.
- 9. Which of the following is a statistical technique that summarizes a number of similar studies?
 - a. majority rules
 - b. meta-analysis
 - c. summation
 - d. a review study
 - e. the assimilation technique
- 10. What is the main criterion that makes a theory scientific?
 - a. explanatory power
 - b. believability
 - c. empirical support
 - d. falsifiability
 - e. an expert opinion
- 11. Leon Festinger's study of a doomsday cult used which form of observational research?
 - a. naturalistic
 - b. participant
 - c. case study
 - d. correlational
 - e. survey
- 12. All *except* which one of the following are advantages of naturalistic and participant observation research?
 - a. absence of control
 - b. providing a full context for behavior
 - c. opportunity to record events difficult to replicate in a laboratory
 - d. observing events too risky to create in a laboratory
 - e. recording events previously observed only by nonscientists

- 13. Which of the following types of surveys discussed in the chapter provides very detailed information but may have the most problems with bias, due to people responding in a socially desirable manner?
 - a. phone
 - b. Internet
 - c. face-to-face
 - d. written
 - e. none of the above
- 14. Why is it that correlational studies cannot determine the cause of the relationship between two variables?
 - a. the third-variable problem
 - b. the reverse-causality problem
 - c. Research correlation rarely exceeds .60.
 - d. all of the above
 - e. a and b
- 15. Which of these correlation coefficients provides the strongest strength between two variables?
 - a. -.90
 - b. .00
 - c. +.20
 - d. +.70
 - e. +1.20
- 16. In Bandura's Bobo doll study, the level of aggressive play of the child in the third room was the _____.
 - a. experimental condition
 - b. control condition
 - c. dependent variable
 - d. independent variable
 - e. random assignment
- 17. Considering the Amelia example, which of the following choices illustrates critical thinking?
 - a. buying the boy bike
 - b. buying the girl bike
 - c. not buying a bike at all
 - d. following her dad's advice
 - e. none of the above

- 18. According to the author, which of the following is a guideline to help in critical thinking?
 - a. Ask questions.
 - b. Base decisions on what you would like to be
 - c. Don't make issues seem too complex; keep it simple.
 - d. Avoid ambiguity.
 - e. Never be wrong.