1

PSYCHOLOGICAL RESEARCH

The Whys and Hows of the Scientific Method and Data

CONSIDER THE FOLLOWING QUESTIONS AS YOU READ CHAPTER 1

- What is the value of research in psychology?
- Why do psychologists conduct research?
- What is the difference between a population and a sample?
- What kinds of data are collected in psychological studies?
- What is a distribution, and how does its shape affect our analysis of the data?

LEARNING OBJECTIVES FOR CHAPTER 1

- Understand that knowledge of research in psychology has value beyond careers in research.
- Understand what it means to learn about behavior through observation.
- Identify different measurement scales.
- Examine data using frequency distributions.

As an instructor of an introductory psychology course for psychology majors, I have asked my first-semester freshman students this question: What is a psychologist? At the beginning of the semester, students typically say that a psychologist listens to other people's problems to help them live happier lives. By the end of the semester and their first college course in psychology, these same students will respond that a psychologist studies behavior through research. These students have learned that psychology is a science that investigates behaviors, mental processes, and their causes. That is what this book is about: how psychologists use the scientific method to observe and understand behaviors and mental processes and how they understand those data using statistics.

The goal of this text is to give you a step-by-step approach to designing research in psychology—from the purpose of research (discussed in this chapter) and the types of questions psychologists ask about behavior; to the methods used by psychologists to observe and understand behavior as well as the statistical tools they use to interpret the data collected about behavior; and finally, how psychologists describe their findings to others in the field.

WHY SHOULD I CARE ABOUT RESEARCH IF I DON'T WANT TO DO RESEARCH IN MY CAREER?

Through my years of teaching psychology methods courses, this question is often asked by students who don't think they want to conduct research in their careers. A few of you might be bitten by the "research bug," as I was as an undergraduate, and find research to be an exciting way to answer questions you have about behavior. Knowing the process of research can help you better understand the topics presented in other psychology courses you may take because you will better understand how this information was gained. However, a majority of students majoring in psychology are interested in working as a practitioner of psychology or may be completing a psychology minor that is related to another career they want to pursue (education, social work, criminal justice, etc.) and do not understand why research methods courses are part of their curriculum. In fact, the majority of individuals who hold a degree in psychology do not conduct research in their jobs. Instead, the majority of individuals working in psychological areas are in helping or other applied professions. However, what we know about behavior in everyday settings comes from research findings. For example, effective treatments and counseling techniques come from research in these areas. When a new treatment technique is tested, its effectiveness is determined by the research conducted on it. Thus, just as medical doctors do, clinicians and counselors must evaluate the latest research in psychology to determine whether a new treatment is one they should adopt. Knowledge of how research is conducted can help them evaluate this research more effectively to aid their practice. In addition, other popular applied areas, such as industrial–organizational psychology and human factors, use research findings to help address issues in everyday life. Industrial–organizational psychologists help organizations hire effective employees, prevent job dissatisfaction, and explore the best training methods for new employees using research findings on these topics (see Photo 1.1). Human factors professionals use research to help understand the best way to design products and interfaces (such as an airplane cockpit—see Photo 1.2) to make them easier to use and prevent errors. Finally, it is important that we as individuals understand how to interpret the vast amounts of information we take in each day through media sources. Research findings are reported by the media every day. Knowing the basics of how research is conducted can help you decide which of those reports you should listen to and which are best ignored. Understanding research can also help you figure out how to decide whether you believe something you read about on social media or not. Learning how to investigate what people know about a topic is part of the research process.


©istockphoto.com/fizkes


©istockphoto.com/choja

Photos 1.1 and 1.2 Knowledge of research can aid in applied areas of psychology, such as industrial–organizational psychology and human factors.

To give you a recent example, in debates about climate change and the seriousness of the problem, many opponents of climate change solutions point out that there is disagreement among scientists about the cause. My own father once told me that this is the reason that he doesn't believe global warming is caused by human activities—some scientists have stated that there isn't enough evidence. As voters and consumers, it is important that we understand which evidence from research is the most valid (i.e., accurate) and that there will almost always be disagreement among researchers in an area because no single study can fully answer a research question. In order to understand what answers research provides on a question, we must consider the accumulation of data in many research studies (and this is what I told my father when he stated his reasoning to me about his beliefs). We must also understand that new knowledge is always being discovered, and we must be flexible in our conclusions about an issue when new data suggest a different answer. Remember, there was a time when most humans believed the sun revolved around the earth. Scientific study revealed this idea to be false, and over time, humans adapted their beliefs to the new knowledge. We must do the same when we learn new findings about the best everyday behaviors, such as how to prevent Alzheimer's disease or how to keep our hearts healthy and live longer.

Understanding research methods can also help you better interpret research study results that are reported in the media. In almost all cases, media sources present concise and simplified reports of a research study and its results, leaving many questions about the quality of the study still to be answered. When one encounters reports of research in the media, some important questions should come to mind. Who were the research subjects? Was an appropriate sample tested? Was an appropriate method used to investigate the question? Were the results published in a high-quality source where other researchers were able to critique the work? How do the results correspond to past studies on this topic? The topics covered in this text and in your methods course will help you ask and answer these questions as you evaluate reports in the media that you can use to make decisions about your life.

Finally, the new knowledge you gain from your study of research methods can help you decide how to evaluate claims made by others in general. When you see an ad on television for a new miracle diet pill that the ad claims has helped people lose weight in studies, should you buy the pill? When your friends tell you that drinking energy drinks helps you study better and achieve higher scores on exams, should you follow their advice? Should you believe claims that vaccines cause autism? (You shouldn't: There's no valid research evidence that vaccinations cause autism.) Hopefully, one of the things you will consider as you learn about research is to be skeptical about claims that seem too good to be true. A good researcher uses the data to decide what is the best thing to do rather than use unsubstantiated advice from others who just sound knowledgeable about a topic but who cannot provide evidence beyond an anecdote or two. Examples of how to evaluate claims and research reported in the media are given in some of the Applying Your Knowledge sections found at the ends of the chapters in this text.

WHY PSYCHOLOGISTS CONDUCT RESEARCH

Think about how you know the things you know. How do you know the earth is round? How do you know it is September? How do you know that reading over your notes will help you prepare for an exam? How do you know that terrorist threats are increasing around the world? There are probably many ways that you know these things. In some cases, you may know things because you used your **intuition** or previous knowledge that led to **deduction** of these facts. For example, you may know from past experience that where you live, in the month of September, days tend to be warm but start to get cooler, especially at night. Therefore, remembering the characteristics of the weather you are experiencing and knowing you are still living in the same location as past years, you can deduce that the month is September from your knowledge base. You can also consult a calendar online, using technology as an authoritative information source. You may have first learned that the earth is round from an **authority** figure such as your parents, teachers, or text authors. You may have also observed that the earth is round by viewing photographs of the earth taken from space. You may know that terrorist threats are increasing from authority figures as well (e.g., magazine and newspaper reporters, your country's leaders' statements). These are the primary ways that we learn new facts: intuition, deduction, authority, and observation.

intuition: Relying on common sense as a means of knowing about the world

deduction: Using logical reasoning and current knowledge as a means of knowing about the world

authority: Relying on a knowledgeable person or group as a means of knowing about the world

Suppose something occurred that caused you to suspect that the authority figures you have learned these facts from are not reliable sources of information. Perhaps they have been caught lying about other facts. You might also consider a situation where you do not have enough previous experience with a topic to deduce the information for yourself. In these situations, what is the best way for you to find the facts? The answer is **observation**. If you had reason to believe, for example, that an increase in terrorist threats is not being represented accurately, you could examine the incidence of terrorist attacks (e.g., from public records) over a period of time to find out if people are representing the true conditions. Observing the world directly is going to give you the most accurate information because you are directly gaining the knowledge yourself—you are not relying on possibly faulty reasoning on your part or information someone may be giving you that is false or misleading. See Table 1.1 for some examples of the different ways of knowing information.

observation: Relying on what one observes as a means of knowing about the world

This is why psychologists conduct behavioral research; it is the best way to make certain that the information they have about behavior is accurate. By conducting careful and systematic observations, they can be certain that they are getting the most accurate knowledge they can about behavior. This does not mean that every study conducted will yield accurate results. There are many cases where the observations collected by different researchers conflict, but this is an important part of the process. Different ways of observing a behavior may yield different observations, and these different observations help us to better understand how behaviors occur. Over time, with enough observations, a clearer answer to the question can be found. But no single research study can "prove" that something is true. Researchers are not able to "prove" facts with a study; the best they can do is support an idea about behavior with their data. Despite the limits of observation as a way of knowing, it is superior to the other methods because it allows for a more objective way of gaining knowledge. Relying on the other ways of gaining knowledge can be misleading because they can be more easily influenced by biases that people have.

TABLE 1.1 ■ Examples of Ways of Knowing Information

Way of knowing	Example
Intuition	I'm trying to go someplace I've never been, but I do not know the way. I decide to turn left because it just "feels like" that's the right way to go.
Deduction	I want to know which direction I am facing. The sun is setting to my right, and I know the sun sets in the west, so I know that south is the direction I am facing.
Authority	I want to know what my pancreas does. I know that my pancreas produces hormones important for digestion because that is what my high school biology teacher told me.
Observation	I want to know how much sleep on average Americans get per night. I determine this by conducting a survey of Americans to learn that most Americans get an average of 6 to 8 hr of sleep per night (e.g., Moore, 2004).


©istockphoto.com/andresr

Photo 1.3
If we want to know how much sleep people get, we can use scientific methods to measure this directly or ask people to report this behavior on a survey.

Using Science to Understand and Explain Behavior

Observation is really what sets scientific fields apart from other fields of study. Someone who wants to know about the political situation during the Civil War may read historical documents and use his or her intuition to describe the situation based on these documents. He or she might also read books by experts (authority figures) on the Civil War period or books on important figures who lived during that time. However, historians typically cannot observe the historical event they are studying. Psychologists have an advantage in that the behavior they want to learn about is happening in humans and other animals in the world around them. The best way to learn about it is to just observe it (see Photo 1.3).

Some behaviors, such as mental processes, cannot be directly observed (e.g., attitudes, thoughts, or memories). Thus, psychologists have developed techniques for inferring information about mental processes through observation of specific behaviors that are affected by these mental processes. Psychologists then attempt to understand mental processes through observation of these behaviors and the investigation of the factors that influence those behaviors. That is what this book (and the course you are taking) is all about—understanding the methods psychologists use to observe, measure, and understand behavior and mental processes.

Research is the foundation of the field of psychology. Many people think of the *helping* professions when they think about what psychologists do. This is because most people with a graduate degree in psychology work in these helping (or related) professions (American Psychological Association [APA], 2003). However, to do their jobs well, helping professionals, such as clinicians and counselors, need to understand the findings from research about behavior so that they know what types of treatments and therapies can best help their clients. The research studies conducted in psychology also help clinicians and counselors understand what constitutes "normal" behavior and what behaviors might be considered "abnormal." Psychological research also informs society about issues related to these behaviors. How do we know when to trust eyewitness testimony based on one's memory and when it is likely to be inaccurate? What is the best way to set up a course to help students remember the information over the long term? What are some daily activities that older adults can engage in that make them less likely to develop dementia? These are some of the applied questions that can be answered with research in psychology. Knowing the results of studies in different areas can help us, as a society, work out some answers to these questions that will be helpful in different realistic situations.

Thinking about the field of biology may help you understand how influential research is in the field of psychology. In the biological field, there are researchers who investigate the way our bodies react physically to the world around us (e.g., after being exposed to a virus). This knowledge helps other researchers determine which drugs may be effective in helping us improve these physical reactions (e.g., reduce our symptoms as we fight the virus). Finally, the knowledge gained in biological research helps doctors correctly diagnose and treat their patients (e.g., what symptoms indicate the presence of a particular virus and which drugs are most effective in treating these symptoms). The field of psychology works a lot like the field of biology (although the term *psychologist* applies to both scientists and practitioners in psychology, sometimes causing confusion). Some researchers investigate what causes certain types of behaviors (e.g., distraction in people with attention deficit hyperactivity disorder [ADHD]). Other researchers investigate what treatments are effective in reducing these behaviors (e.g., rewarding someone for staying on task). Finally, some psychologists work with clients to help them deal with problem behaviors. For example, school psychologists work with teachers and parents to develop a reward system for students with ADHD who have difficulty completing work in class because they become easily distracted. The research that investigated the behaviors associated with ADHD and the factors that can reduce those behaviors was necessary in order for the school psychologist to be able to develop an effective treatment plan for the student.

In the next section, we will begin to examine how observations of behavior occur in research studies.

STOP AND THINK

1.1. Think about some things you know are true about the world. For each of these facts, try to determine the way you know that information (intuition, deduction, authority, or observation).

1.2. Suppose you wanted to know about the factors that cause college students to become anxious. Describe how you might learn about these factors by using observation.

1.3. Explain how the fields of psychology and biology are similar.

POPULATIONS AND SAMPLES

Have you ever wondered about the opinion polls presented by media news sources and how accurate they are? Consider a poll done on global warming by ABC News/*Washington Post* taken in November 2015 (http://www.pollingreport.com/enviro.htm). People were asked if they considered global warming a serious problem facing the country (see Photo 1.4). From those polled, 63% said yes, it was a serious problem (the highest response on this measure). We can compare this with a poll conducted in May and June of 2015 by the Pew Research Center (http://www.pollingreport.com/enviro.htm). In this poll, people were asked if global warming was a serious problem, and only 46% said it was very serious (the highest response on this measure). Why is there such a large difference between the reported percentages? Did many people suddenly decide that global warming was a big problem between June and November? This is one possible explanation,

Photo 1.4
How many people believe that global warming is a serious problem? Polls can provide some information about this, but it is important to consider the sample and population for the poll to determine its validity.

but it is not very likely. Another possible explanation could be that different people answered the question in the two polls. One way to determine this is to look at the information provided about the polls. The ABC News/*Washington Post* poll describes that it was from 1,004 adults nationwide (in the United States) with a margin of error of plus or minus 3.5. The Pew Research Center poll describes that it was from 5,122 adults nationwide with a margin of error of plus or minus 1.6. Is this information important? What does it tell us about the **validity** of the polls?

In fact, the information provided about the polls can be important in deciding whether the information from the poll is accurate (i.e., valid). The Pew Research Center poll surveyed more people, which allowed for a smaller margin of error. This means we can be more certain that the percentage of all adults in the United States who would report global warming as a very serious problem is close to 46%. What we're looking at here is the difference between a **population** and a **sample**, and the information provided helps us determine how well the sample represents the whole population (see Figure 1.1). The *population* in this case is all adults in the United States. This is the group of individuals we are trying to learn about with the poll. The *sample* is the set of people who answered the question in the poll. They were selected from the population in an attempt to represent the opinions of the whole population without having to ask the whole population (which would be impossible, given the population's size). How well the sample represents the population of interest is a function of the sample size, the way in which the sample was chosen, how many people chosen actually responded or chose to participate, and a few other factors that researchers must consider when conducting any type of research study. Differences between the sample and the population contribute to **sampling error**. Sampling error exists any time we collect data from a sample of the population because we will never be able to get the exact population data from a sample of the population. Each sample is a different subset of the population and will provide different scores, resulting in different means across samples. We're trying to estimate the population mean using the sample mean, so with each sample, we will be at least a little bit wrong about the population mean. This difference between the sample mean and the population mean is the sampling error.

validity: The accuracy of the results of a study

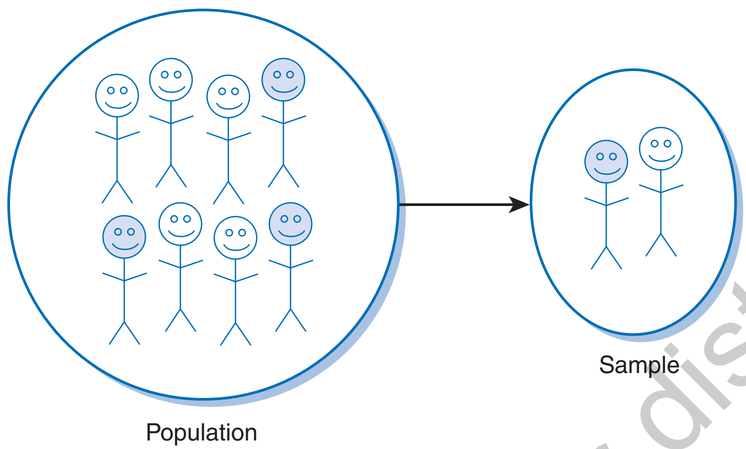
population: A group of individuals a researcher seeks to learn about from a research study

sample: The group of individuals chosen from the population to represent it in a research study

sampling error: The difference between the observations in the population and in the sample that represents that population in a study

One way to think about this is to imagine someone trying to figure out what picture is on a puzzle with only a small part of the puzzle put together. We're not likely to understand the whole picture from just one part of the puzzle; however, the more of the puzzle we have together (i.e., the larger the sample size), the better we'll be at guessing the picture. But putting the whole puzzle together would be difficult and time-consuming if there were thousands or millions of pieces. So instead, we make our best guess from the part of the puzzle we can put together in our study (the sample). With only a small part of the puzzle put together, though, we're not going to get the whole picture exactly

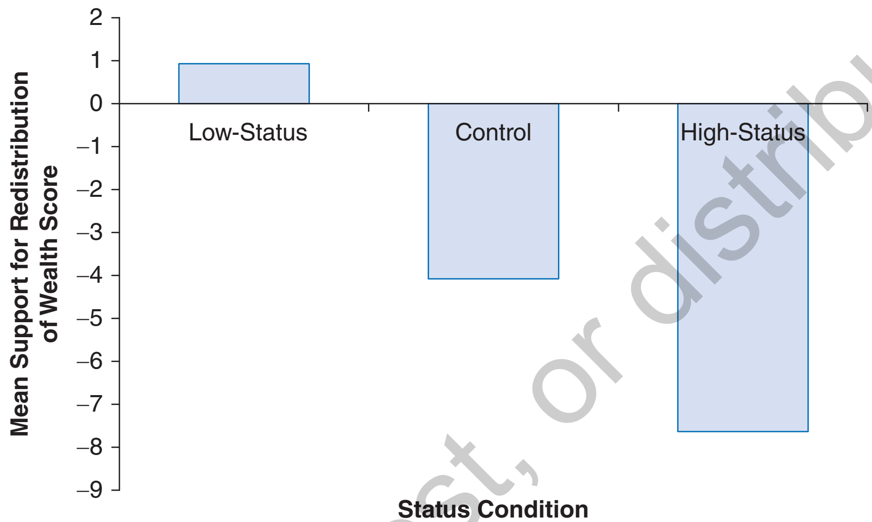
FIGURE 1.1 ■ The Sample Is Chosen to Represent the Population in a Study



right. Thus, there is some error in our estimate of the population data from our sample data (sampling error). The margin of error reported for polls (such as those described here) provides an estimate of the sampling error. This is an estimate of how far off the reported percentage in our data is likely to be from the population percentage. Thus, knowing the sample size and margin of error for opinion polls can help you decide if the poll is useful in telling you how people really think about an issue.

It is very rare that a researcher will observe the entire population in a research study, so samples are almost always used in order to represent the population in the study by collecting data from a realistic number of individuals. This is due to the size of most populations; they tend to be very large because researchers want to be able to learn about the behavior of large groups of individuals, not just a small set of people—as in our survey examples where we wanted to know about how Americans felt about global warming. Thus, a smaller sample was chosen to collect data from. If you have ever participated in a research study, then you have been a member of a sample selected from a population. Many research studies in psychology use samples selected from the population of college students because it is a sample that is fairly easy to obtain. However, *college students* is too narrow a population for some studies because college students tend to be fairly educated, higher income, and young, giving us a biased sample for these characteristics from the whole population of adults. Because of this possible bias, researchers have begun to sample from larger populations of individuals using online technologies to deliver surveys and experimental tasks to a larger population. For example, a fairly recent study by Brown-Iannuzzi, Lundberg, Kay, and Payne (2015) sampled their participants from a large population of adults using the Amazon site Mechanical Turk (MTurk). This site rewards people with small amounts of money in their account for completing research studies. Brown-Iannuzzi et al. sampled individuals from this site to learn how one's sense of one's own wealth, relative to others' wealth, influences one's political ideas about the redistribution of wealth in society (their research suggested that relative wealth does

FIGURE 1.2 ■ Results From Brown-Iannuzzi et al.'s (2015) Study Comparing Support for Redistribution of Wealth Based on Experimental Conditions of Relative Wealth Compared With Others' Wealth; Greater Support for Redistribution Was Found for Low-Status Participants Than for High-Status Participants



Source: Brown-Iannuzzi et al. (2015).

affect one's political ideas on this issue; see Figure 1.2). MTurk is becoming a popular method for selecting a large sample from the very large population of adults in the world. We will consider more issues of sampling in Chapter 4.

The population and sample of a research study are important for choosing the statistical tools researchers use to better understand data. As you will see in Chapter 4, the way that you choose a sample from a population can affect the validity of your study. Discussions in the later chapters of this text will show you how hypotheses are made about populations before a sample is chosen. Finally, the type of data collected from the sample will influence the statistics we choose to summarize the data (i.e., **descriptive statistics**) and to test our hypotheses about the population (i.e., inferential statistics).

descriptive statistics: Statistics that help researchers summarize or describe data

TYPES OF DATA

operational definition: The way a behavior is defined in a research study to allow for its measurement

There are many different types of data that can be collected in psychological research studies. Researchers attempt to choose the best measure for the behavior they want to observe. This choice is important because it can affect the internal validity of the study—a poor choice can mean that the data do not actually measure the behavior of interest. In other words, researchers try to determine a good **operational definition** of the behavior they are


©iStock/AntonioGuillem

Photo 1.5
There are many ways to measure depression; a researcher operationally defines the behavior to allow its measurement.

interested in. An operational definition is the way a behavior is measured in a particular study. It also provides a way for a researcher to measure a behavior that is not directly observable. Operational definitions are a necessary part of the research process because many behaviors can be defined in multiple ways, and researchers need to know what to measure from the individuals in the sample when they collect their data. For example, what behaviors should be measured to learn about one's level of depression (see Photo 1.5)? There are many ways we could operationally define depression: how often someone smiles in an hour (fewer smiles = more depression), observers' ratings of how lethargic someone seems (lower ratings of energy level = more depression), or a score on a questionnaire of self-reported thoughts and behaviors that we think are present in someone who is depressed (more sleep than is typical, loss of appetite, feelings of sadness, etc.). Thus, researchers have many choices when they want to measure depression, and they try to come up with the most valid measure (within the practical limitations of the research study) for the behavior they want to learn about.

Scales of Measurement

Observations of behavior (i.e., data) in a study constitute what is called a **dependent or response variable**. Dependent variables are measured in every research study. For some designs, only a single dependent variable is measured, and the behavior is examined descriptively or causally (if the researcher is interested in a causal relationship and uses an experiment to study this relationship). Other designs examine relationships between multiple dependent variables. As a result, how a dependent variable is measured depends on the data collection technique used, and what is learned about a dependent variable depends on the type of research design used. One choice that is made by the researcher in operationally defining a behavior for a research study is the scale of measurement he or she uses. The scale of measurement will be important in determining which statistics are used to describe the data and test hypotheses about the data. Table 1.2 presents an overview of the different scales of measurement and an example of each type.

dependent or response variable: A variable that is measured or observed from an individual

Nominal Scales

Many measurements categorize observed behavior or behavior that is reported by the participants. For example, if you ask someone to indicate their current mood, you might give them response choices such as happy, sad, excited, anxious, and so on. This type of measurement is called a **nominal scale** because it involves nonordered categories that are nonnumerical in nature. You cannot order these moods from highest to lowest—they are simply different. Some types of demographic information collected in research studies are measured on a nominal scale. Questions about someone's gender or major in college are good examples of these types of nominal scales.

nominal scale: A scale of data measurement that involves nonordered categorical responses

TABLE 1.2 ■ Scales of Measurement

Scale	Definition	Example
Nominal	Unordered categories	University where degree was earned
Ordinal	Categorical, ordered categories	Letter grades earned in a course (A, B, C, D, F)
Interval	Numerical categories without a true zero point	Ratings on personality surveys with values from 1 to 5
Ratio	Numerical categories with a true zero point	Age measured in days since birth

Ordinal Scales

ordinal scale: A scale of data measurement that involves ordered categorical responses

Anytime you rank order your preferences for different things, you are using an **ordinal scale**. Rankings in a competition (1st, 2nd, 3rd, etc.) also measure individuals on an ordinal scale. Ordinal scales are measures that involve categories that can be ordered from highest to lowest. However, the ordered categories are not necessarily equally spaced on an ordinal scale. Imagine you are asked to report your level of anxiety today on a scale that includes response choices of *not at all anxious, a little anxious, fairly anxious*, and *very anxious*. On this scale, the difference between *a little anxious* and *fairly anxious* may be smaller than the difference between *fairly anxious* and *very anxious*. Thus, this is considered an ordinal scale because the categories can be ordered from highest to lowest level of anxiety, but the categories are not always equally spaced across the scale.

Interval Scales

interval scale: A scale of data measurement that involves numerical responses that are equally spaced, but the scores are not ratios of each other

If the ordered categories on a scale are equally spaced, then the scale is known as an **interval scale**. Interval scales are used when the researcher wants to know that the difference between any two values on the scale is the same across all values of the scale. Typically, this involves numerical responses. Many rating scales on questionnaires are interval scales because they ask participants to rate their agreement with statements or their likelihood of performing specific behaviors on a numerical rating scale. An example of such a scale might be to rate how much you agree with the statement "Global warming is a serious issue facing society today" on a scale of 1 to 10, where a higher number indicates higher agreement. Such scales do not have a true zero point, because the values cannot be considered ratios of one another. For example, because there is a minimum and maximum score on a 1 to 10 scale, there is no way to determine the ratio function between scores—a score of 4 is not twice that of a score of 2 (2 is only one value higher than the minimum, whereas 4 is three values higher than the minimum). The scores on the scale are not distributed in this way.

Ratio Scales

ratio scale: A scale of data measurement that involves numerical responses in which scores are ratios of each other

A numerical scale with a true zero point allows for values that are ratios of one another. This is known as a **ratio scale**. On ratio scales, you can determine what score would be twice as high as another score. Some examples of ratio scales are accuracy on a task, speed to complete a task, and age. A score of 50% accuracy is twice as high as a score of 25% accuracy. Ratio scales are often used in systematic and controlled measures of behavior, a topic we will discuss later in this chapter. Note that interval and ratio scales are often grouped together because data from these scales are typically analyzed in the same way, and there are cases where it is difficult to determine if a scale is truly an interval scale. The important difference to note for the scales of measurement and how they are analyzed is whether they involve numbers or categories as responses on the scale.

STOP AND THINK

1.4. For each study description that follows, identify the population and the sample.
   a. A researcher recruits students from a fifth-grade class at an elementary school to examine math abilities on a standardized test in children who are 9 to 10 years old.
   b. A researcher recruits college students from the university subject pool to test the effect of time pressure on accuracy in completing a task.
   c. Older adults are recruited from a retirement center to examine sources of anxiety in retirees. Anxiety is measured using survey items in which the participants rate their level of anxiety on a 1 to 7 scale for different issues that might be anxiety inducing (e.g., financial security, failing health).
   d. Patients who have suffered a traumatic brain injury (TBI) are included (with their consent) in a study of how one's diet after the injury affects recovery time (measured in number of days they stay in the hospital after their injury) from a local hospital.

1.5. For each study described in 1.4, identify the most likely scale of measurement used in the study.

Survey Data

We have already discussed some issues with sampling from populations to collect survey data in this chapter. Using surveys to measure behavior can also limit the types of measures that a researcher can use to observe those behaviors. Although any of the scales of measurement described in this chapter can be used in surveys, the measures are limited to an individual's report of their thoughts and behaviors. In other words, surveys indirectly measure the behavior of interest in a study. They rely on responses to items that together provide information about the behavior. The survey score is an operational definition of that behavior. However, the way survey responses are presented can greatly affect the results. Consider the surveys on global warming described at the beginning of this chapter. Do you notice any differences in the types of responses used in the polls? In fact, the difference in survey response options is likely the reason for the differences in the percentage of people who agreed with the survey statement. In the first survey, people stated that global warming was a *serious problem*. In the second survey, the percentage reported was for people who *very strongly agreed* with this statement. It may be that a fair

©iStock/mediaphotos

Photo 1.6 Survey responses can be prone to social desirability bias in which participants try to respond in a way that makes them look more positive.

percentage of people in the second survey chose a response of *strongly agree* instead of *very strongly agree*. In the first survey, there was no *very strongly agree* option, so some of the people who chose the *serious problem* response may in fact have felt very strongly about their agreement. Because the response choices are different in the two surveys, it can appear as if they obtained different results.

In addition, there are some issues related to the self-report nature of survey data that can influence the validity of the data. Because surveys rely on reports of the behavior from the participants themselves, the validity of the measurement may not be as high as when the researcher directly observes those behaviors. Participants may not have an accurate perception of their own behaviors, making the reports subjective. Further, participants may wish to portray their behaviors more positively than they actually are—an issue known as **social desirability bias**. If participants respond to survey items in a way that makes them appear more positive, they are reducing the validity of the behavioral measure (see Photo 1.6).

social desirability bias: Bias created in survey responses from respondents' desire to be viewed more favorably by others, typically resulting in overreporting of positive behaviors and underreporting of negative behaviors

Because survey data have some issues that can affect their validity, researchers are careful in checking the **construct validity** of surveys and questionnaires when they are first used to make sure that they accurately measure the behaviors of interest. **Reliability** of surveys and questionnaires is also examined before they are used as measures of a behavior to ensure that they will produce consistent results when they are used in research studies.

construct validity: The degree to which a survey is an accurate measure of interest

reliability: The degree to which the results of a study can be replicated under similar conditions

Systematic and Controlled Measures

Another type of data collected in many research studies is more systematic and controlled. In experimental studies, where internal validity is increased through control of the measurement of the behaviors and the situations in which they are observed, researchers often employ more systematic and controlled measures (see Photo 1.7). These measures are more direct observations of behavior than the self-reports collected on surveys (e.g., accuracy or speed in performing a task), which can provide more internally valid measures of behavior, but they can also have lower external validity than the behaviors measured in surveys because the control imposed during the observations can influence the behaviors observed. When someone knows they are participating in a research study, they may try harder in completing a task (or may perform worse due to lack of motivation because they know they will get research credit regardless of their performance), changing their accuracy and speed in performing the task compared with a more naturalistic setting.

Consider the experiment conducted by Metcalfe, Casal-Roscum, Radin, and Friedman (2015) to compare older and younger adults' memories for facts. Both young and older adults were asked to answer a series of general knowledge questions (e.g., "In what ancient city were the Hanging Gardens located?" Correct answer: Babylon). For each answer, they provided a rating of their confidence in their response on a 1 to 7

©iStock/LuckyBusiness

Photo 1.7 Systematic measures of behavior sometimes involve collecting responses on a computer to allow for direct measures of behavior in terms of speed or accuracy in completing a task.

scale. Feedback was then given for their answer (correct or incorrect with the correct answer given as feedback). After a short delay, they were then tested on 20 of the questions for which they made high-confidence errors (i.e., they answered incorrectly but were highly confident in their incorrect response) and 20 questions where they made low-confidence errors (i.e., they answered incorrectly but were not very confident in their incorrect response) to determine final test accuracy on these questions. The mean accuracy for each group and type of question is shown in Figure 1.3. Older adults showed better memory on the final test—an atypical finding—especially when they had low confidence in their original response. The researchers measured memory accuracy as a controlled measure: They carefully chose the items presented to the participants and tested their memory in a lab, where they could control other factors that contribute to memory other than the age group and the participants' confidence in their responses. This control increased the internal validity of the study in providing a good test of the comparison of younger and older adults. However, this control of the measure and the situation may have reduced the realism of the memory being tested. For example, because the participants knew that the researchers were interested in their memory performance, they may have tried harder on the task (especially the older participants, for whom research participation may be a less-common experience) and raised their memory levels compared with how they would perform in a less-controlled setting. This shows how controlled observations of behavior can have high internal validity but may also have lower external validity.

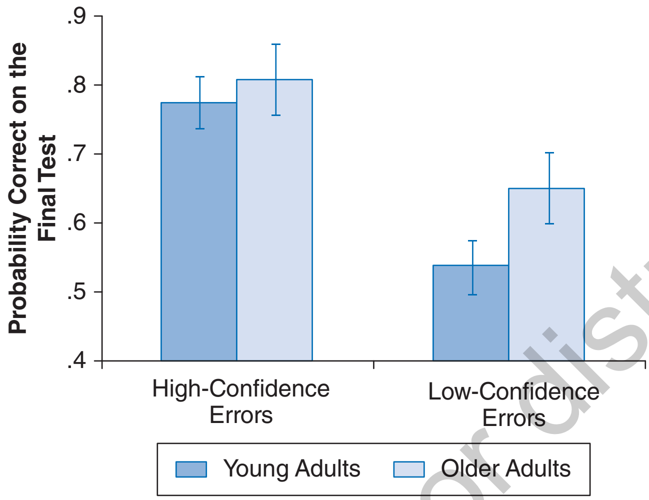
FREQUENCY DISTRIBUTIONS

Let's now consider what the data we collect in a study might look like. When we collect a set of data, we have a **distribution** of scores to consider. This distribution might range over the entire scale of measurement (e.g., participants have used all of the values on a 1 to 7 rating scale in their responses), or it might be restricted to just a small range of scores (e.g., participants have used only the values between 3 and 6 on the 1 to 7 rating scale). In addition, the scores might cluster close to one value on the scale with very few values at the high and low ends of the scale. Or the scores could be equally spaced along the values of the scale. Thus, different distributions can have different characteristics depending on the variability seen in the scores. A good way to examine the distribution and see what it looks like is to create a **frequency distribution** table or graph. The frequency distribution will indicate how often each value in the scale was used by the participants in their responses or in measurements of their behavior.

distribution: A set of scores

frequency distribution: A graph or table of a distribution showing the frequency of each score in the distribution

FIGURE 1.3 ■ Memory Accuracy Data From Metcalfe et al.'s (2015) Study



Source: Metcalfe et al. (2015).

To create a frequency distribution graph by hand, you place the scores on the x-axis of the graph and then indicate the number of times each of those scores appears in a set of data with the bar height along the y-axis. Figure 1.4 shows a frequency distribution graph for responses on a 1 to 7 scale that might be present from a survey question asking how likely someone is to watch a new show on television after watching an ad for that show. The graph shows that the respondents used all the scores on the scale, but most of the scores were clustered around the values of 5 and 6 (these were the most frequent scores in the distribution). Table 1.3 shows a frequency distribution table of the same set of scores. To create the table, the scores are listed in one column, and the frequency count of each of the scores in the distribution is listed in the second column. For example, 16 respondents rated their likelihood of watching the new show at a 6 on the 1 to 7 scale. The other columns in the table show the percentage of all the scores in the distribution at that value and the cumulative percentage from lowest to highest that adds in all previous percentages as you move from one score to the next.

Shape of a Distribution

inferential statistics: A set of statistical procedures used by researchers to test hypotheses about populations

One thing we can see more easily using a frequency distribution graph is the shape of the distribution. The shape of the distribution can affect the choices a researcher makes in analyzing the data with **inferential statistics**. Look at the frequency distribution in Figure 1.4. What do you notice about its shape? Is the distribution symmetrical, with the half of the distribution above the most frequent score (a score of 6) the mirror image of the other? Or are the scores clustered more toward one end of the distribution than the other? If the distribution shows a mirror image across the most frequent score, then it is

FIGURE 1.4 ■ A Frequency Distribution Graph for Ratings on a 1 to 7 Scale of How Likely One Is to Watch a New Television Show

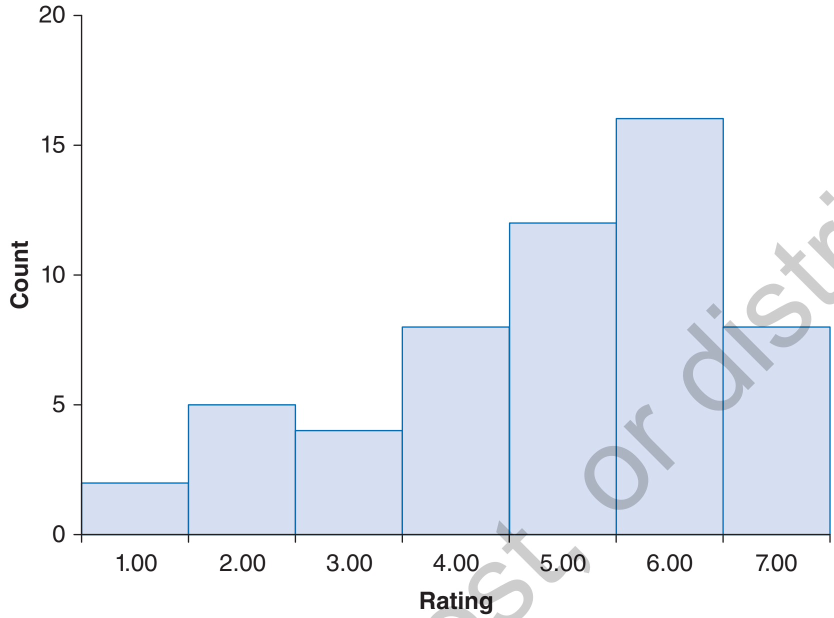


TABLE 1.3 ■ A Frequency Distribution Table for Ratings on a 1 to 7 Scale of How Likely One Is to Watch a New Television Show

Score	Frequency	Percentage	Cumulative percentage
1	2	3.6	3.6
2	5	9.1	12.7
3	4	7.3	20.0
4	8	14.5	34.5
5	12	21.8	56.4
6	16	29.1	85.5
7	8	14.5	100.0

a **symmetrical distribution**. Symmetrical distributions occur naturally in some types of data. For example, standardized test scores typically show symmetrical distributions with an average score in the center and each half of the distribution around the average

symmetrical distribution: A distribution of scores where the shape of the distribution shows a mirror image on either side of the middle score showing fewer scores at each end of the scale in a similar pattern (i.e., a typical bell shape). Figure 1.5 shows a fairly symmetrical distribution of data in a frequency distribution graph. These data represent the distribution of letter grades in a college course where the instructor has "curved" the grade distribution around an average grade of C (i.e., made it symmetrical around the C grade).

Many distributions, however, show clustering of scores toward the top or bottom end of the scale. In fact, without curving, grade distributions in many college courses show a clustering of grades toward the high end of the grade scale—often because there are more people in a course who do well than who do very poorly. When scores are clustered at one end of the scale or the other in a distribution, it is known as a **skewed distribution**. Skew in a distribution can affect the comparison of different measures of what is considered a typical score (as you will see in Chapter 6). Speed in completing a task often shows a skewed distribution, especially if the research participants complete multiple trials of the task. For example, a task speed distribution is shown in Figure 1.6. You can see in this distribution that most of the scores cluster toward the low end of the scale because the participants are trying to complete the task quickly, based on the instructions. However, there are a few scores higher up on the scale where a participant was especially slow in completing the task. This could be due to a short lapse in attention or a particularly difficult trial that affected their speed. However, there will not be the same pattern of very

skewed distribution: A distribution of scores where the shape of the distribution shows a clustering of scores at the low or high end of the scale

FIGURE 1.5 ■ A Symmetrical Distribution of Scores—Letter Grades in a Course That Has a Curved Scale

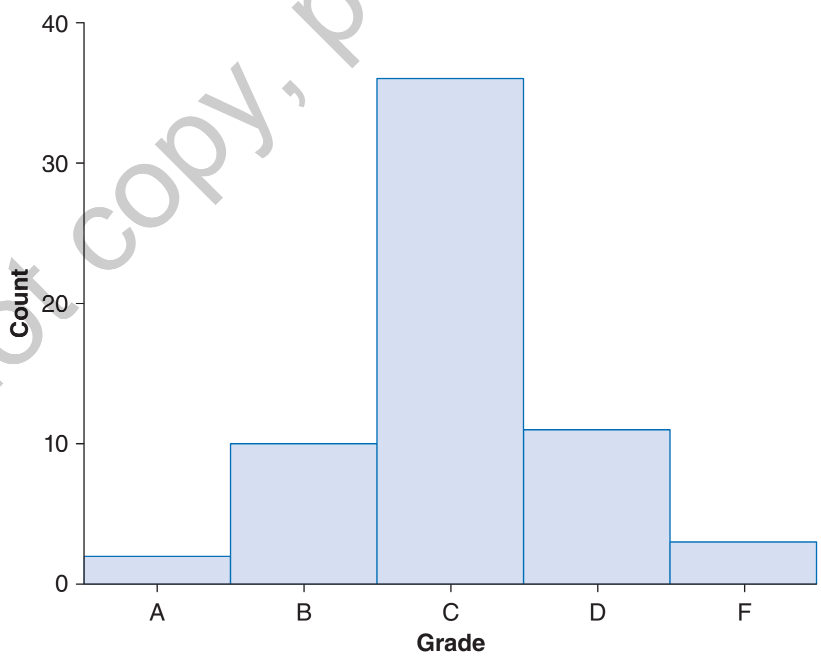
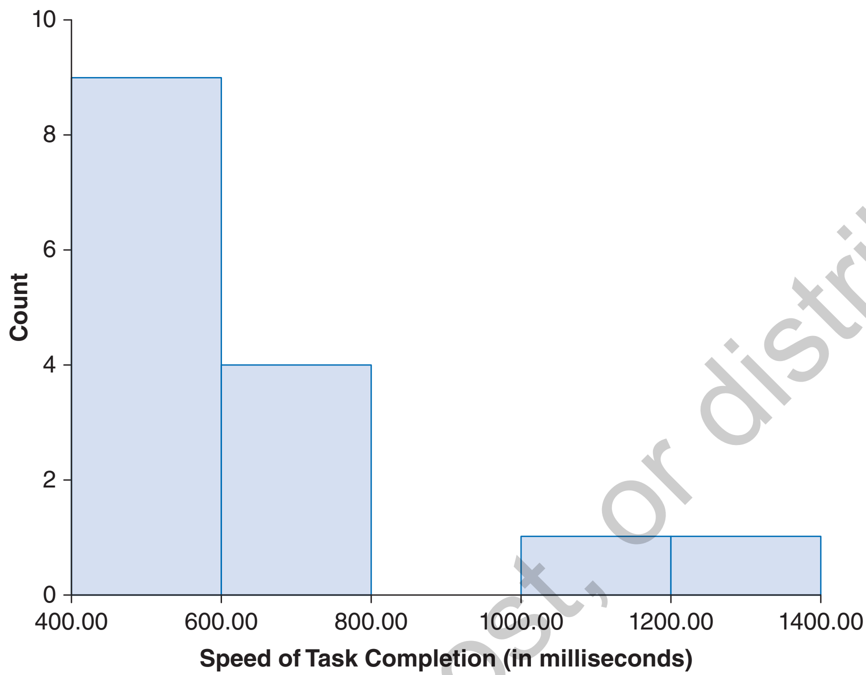


FIGURE 1.6 ■ A Skewed Distribution of Scores—Speed of Task Completion



fast trials at the low end of the scale because the lowest the scores can go is 0 on the scale, keeping the fast scores from spreading out at the low end. This is why most distributions of data that measure task speed are skewed. This distribution represents a *positive skew*, where the tail of infrequent scores is at the high end of the scale. A *negative skew* shows the opposite pattern—the tail of the distribution is on the low end of the scale.

STOP AND THINK

1.6. Explain how internal validity is increased in a study using systematic and controlled measures of behavior.

1.7. Create a frequency distribution table or graph for the following set of data using ranges of scores by 10 (i.e., frequency for 51–60, 61–70):

77, 75, 78, 56, 90, 68, 65, 63, 73, 77, 74, 78, 72, 79, 82, 85, 88, 52, 96, 71

Does this distribution appear to be symmetrical or skewed in shape? Explain your answer.

Frequency Distributions in Excel

In this text, we will discuss two ways to use computer programs to produce statistics. Although it is important for you to understand what is contributing to the statistics being produced by the programs, most researchers use computer programs to calculate statistics for their data. Therefore, in this text you will see both the formulas and calculations for the statistics and the instructions for producing those statistics using the computer programs. The first program we will consider is Microsoft Excel. Excel can be used to create frequency distribution tables and graphs. Let's work through an example of how it works using the distribution of data shown in Figure 1.4 and Table 1.3. These data are hypothetical ratings for likelihood of watching a new television show after viewing an ad for the show.

Tables

We will begin by entering the rating scores. You can follow along with the example if you have Excel to work with as you read. The first step is to type the data into the data window. This is the first column shown in Figure 1.7. The data are entered with one score per row. They are presented in order from lowest scores to highest scores, but the order of the data entry in this column is not important; you can enter them in any order. Here are the data to enter: 1, 1, 2, 2, 2, 2, 2, 3, 3, 3, 3, 4, 4, 4, 4, 4, 4, 4, 4, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 7, 7, 7, 7, 7, 7, 7, 7. Type these ratings into the first column in your Excel data window. In the next column, enter in the response

FIGURE 1.7 ■ Excel Data Window Showing a Frequency Distribution Table

	A	B	C	D	E
1	DATA	SCORES	COUNTS	PERCENTAGE	CUMULATIVE PERCENTAGE
2	1	1	2	3.636363636	3.636363636
3	1	2	5	9.090909091	12.72727273
4	2	3	4	7.272727273	20
5	2	4	8	14.54545455	34.54545455
6	2	5	12	21.81818182	56.36363636
7	2	6	16	29.09090909	85.45454545
8	2	7	8	14.54545455	100
9	3				
10	3				
11	3				
12	3				
13	4				
14	4				

Note: Excel is a registered trademark of Microsoft Corporation.

choices—the values from 1 to 7. In some cases, you may not have exact scores to enter here, but because these data are from a survey with a rating scale, we can enter the exact scores that are in the distribution.

The third column will include our counts for each score. You could count these by hand from the list of data that was just given, but for large data sets, this would be time-consuming, and you might make a mistake. Instead, we can use the formulas in Excel to calculate the counts. We will use the COUNTIF command here. To use a command in Excel, type = and then the command; so in the COUNTS column's first cell, you can type =COUNTIF. The COUNTIF command will include the **range** of scores you want to count (all the scores in the DATA column) and the specific score you want to count. Your COUNTIF command will be =COUNTIF(range,score). To calculate the counts, type a (, then highlight all of the scores in the DATA column to enter the range (by dragging the cursor over the whole column), and then type ,"="& (comma, quotation mark, equal sign, quotation mark, ampersand). Then highlight the score in the SCORES column you want to count (or you can just type in the score you want). This will then add the score you are looking at. If you want a range of scores here, you can use COUNTIFS (instead of COUNTIF) and include sets of < or > before the & and score to indicate a range. Close the) and then hit Enter. If you included labels at the top of the columns as in Figure 1.7, your first cell should look like this before you hit Enter (you can see the formula by clicking on a cell to show it in the bar at the top):

range: The difference between the highest and lowest scores in a distribution

=COUNTIF(A2:A56,"="&1) or =COUNTIF(A2:A56,"="&B3)

You should see a count of 2 in the COUNTS column for a score of 1 (see Figure 1.7). Repeat this formula for each score to calculate counts in your COUNTS column.

The next column in our frequency distribution table is the percentage of the total that each count represents in the data set. To calculate this value, type =, highlight the value in the COUNTS column, then /COUNT(. Then highlight the scores in the DATA column and type). Then type *100 and hit Enter. Your first cell should look like this (again, if you have a column header):

=C2/COUNT(A2:A56)*100

You should see the percentage of scores that had a value of 1 in the data set in the PERCENTAGE column (see Figure 1.7).

The last column in our table is the cumulative percentage of values for each score. This will tell us what percentage of the scores is at a certain value or lower. To calculate this value, again begin by typing = to indicate a formula, then highlight the next value in the PERCENTAGE column, type +, and then highlight the previous value on the CUMULATIVE PERCENTAGE column (if there is one) before hitting Enter. For the first score, the cumulative percentage will simply be the percentage value. Your completed table should look similar to the one shown in Figure 1.7.

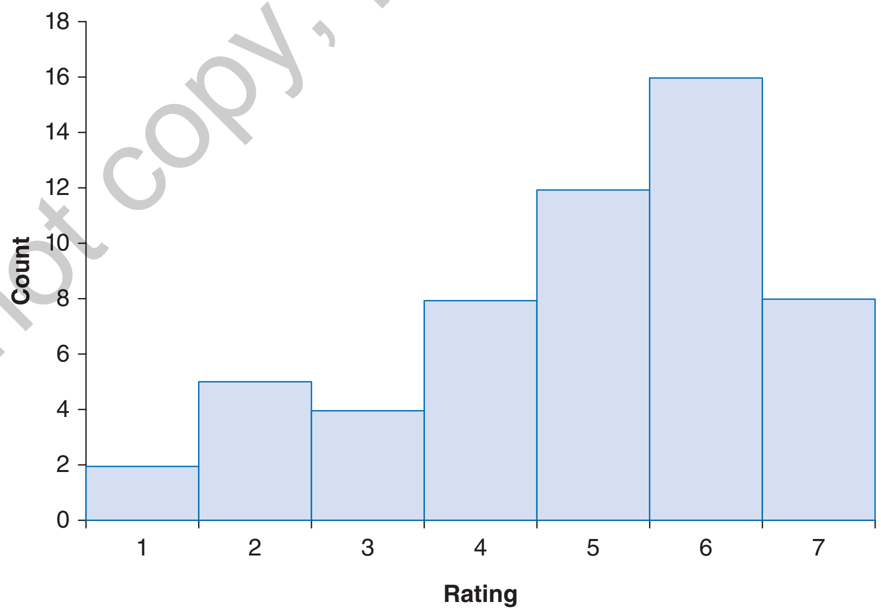
SUMMARY OF STEPS

- Type the data into a data window in Excel (1st column).
- Type in response choices (2nd column).
- Type in =COUNTIF(range, scores) command (3rd column).
- Repeat COUNTIF command for each score or range of scores to complete third column.
- Calculate percentages for each score using =score cell/COUNT(range)*100 (4th column).
- Calculate cumulative percentages by successively adding up the percentages for each score (5th column).

Graphs

Excel can also create a frequency distribution graph of these data for us. To create the graph, highlight the SCORES and COUNTS columns of values. Then click the Charts function window. Excel's default is typically a bar graph for these types of data, but your settings may be different, so you may need to choose the Column Graph option. To show the distribution shape, choose the option under Chart Layouts that shows the bars adjacent in the graph. You should then have a graph that looks like the one in Figure 1.8. You can type in axis labels and change the fill color of the bars to format as you like.

FIGURE 1.8 ■ Excel Chart Showing a Frequency Distribution Graph



Frequency Distributions in SPSS

The second computer program I will describe in this text is IBM® SPSS® Statistics.[1] SPSS is a common program used by researchers for descriptive and inferential statistics in psychology. You may be asked to use this program in some of your psychology courses to analyze data from research studies. In many cases, it will produce the statistics you want more easily than Excel. However, this program is not as commonly available as Excel, which is why there is instruction for both programs provided in this text.

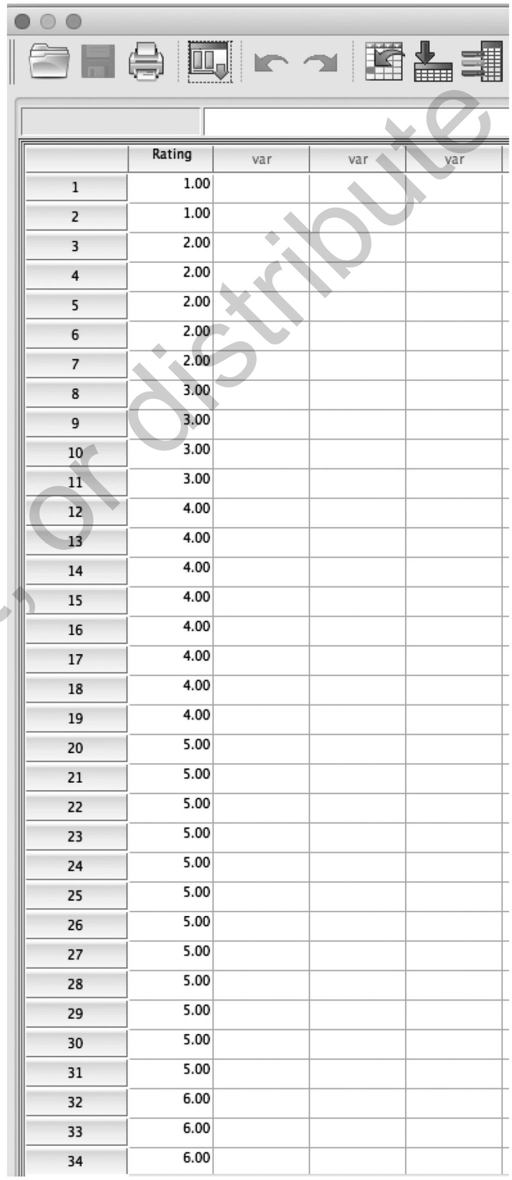
Note: SPSS is a registered trademark of International Business Machines Corporation.

Tables

As with Excel, the first step in using SPSS is to enter the data you wish to examine. The data window in SPSS has a similar setup to the one in Excel. However, you will define the variable names and details in a separate tab of the window. An example of the data window in SPSS is shown in Figure 1.9. As in Excel, each row contains data from a different participant, and each column indicates a different variable. Thus, the first column contains the ratings for desire to watch the television show for each participant from our earlier example as in the Excel window. However, to label this variable, you need to choose the Variable View tab at the bottom of the window. This view will allow you to name the variable (as I have done here with the label *Rating*). See Figure 1.10 for the Variable View in SPSS.

Once your data are entered and labeled, you are ready to create your frequency distribution table. To create a table, you will choose the Frequencies function in the Descriptive Statistics menu under the Analyze menu at the top. Different versions of SPSS look a bit different for these menus, so first find the Analyze menu (or tab) at the top of the window; then choose Descriptive Statistics and then Frequencies. You should see a small window pop up that looks like Figure 1.11. To create the table for the ratings, make sure the Rating variable is highlighted (if not, click on it), and then click the arrow to move it into the Variable(s) box. Be sure to keep the Display frequency tables box

FIGURE 1.9 ■ Data Window for SPSS



	Rating	var	var	var
1	1.00			
2	1.00			
3	2.00			
4	2.00			
5	2.00			
6	2.00			
7	2.00			
8	3.00			
9	3.00			
10	3.00			
11	3.00			
12	4.00			
13	4.00			
14	4.00			
15	4.00			
16	4.00			
17	4.00			
18	4.00			
19	4.00			
20	5.00			
21	5.00			
22	5.00			
23	5.00			
24	5.00			
25	5.00			
26	5.00			
27	5.00			
28	5.00			
29	5.00			
30	5.00			
31	5.00			
32	6.00			
33	6.00			
34	6.00			

[1]SPSS is a registered trademark of International Business Machines Corporation.

FIGURE 1.10 ■ Variable View Window for SPSS

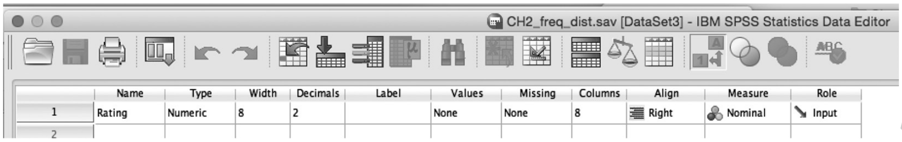


FIGURE 1.11 ■ Frequencies Window in SPSS

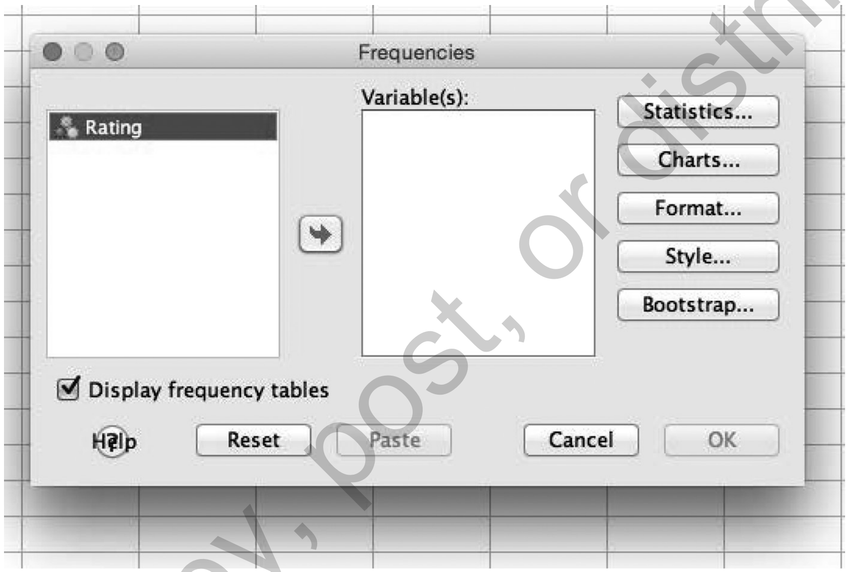


FIGURE 1.12 ■ Frequency Distribution Table in SPSS, Seen in the Output Window

Rating

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	2	3.6	3.6	3.6
	2.00	5	9.1	9.1	12.7
	3.00	4	7.3	7.3	20.0
	4.00	8	14.5	14.5	34.5
	5.00	12	21.8	21.8	56.4
	6.00	16	29.1	29.1	85.5
	7.00	8	14.5	14.5	100.0
	Total	55	100.0	100.0	

checked. The OK button should then be available. When you click OK or hit Enter, a new Output window will appear. Your table will be displayed as shown in Figure 1.12. The Valid column shows the scores in the distribution, the Frequency column shows the counts for each score (including a total count), the Percent and Valid Percent columns show the percentage of scores in the distribution that are at that score, and the Cumulative Percent column shows the cumulative percentage for each score. You can compare this table with those shown in Table 1.3 and Figure 1.7 to see the similarities across the different program versions of the same table.

SUMMARY OF STEPS

- Type the data into a data window.
- Label the variable in Variable View tab.
- Choose Descriptive Statistics in the Analyze menu at the top.
- Choose Frequencies from the Descriptive Statistics choices.
- In the Frequencies window, choose the variable(s) you are interested in by highlighting the variable(s) and using the arrow in the center of the window.
- Make sure the Display Frequency Tables box is checked.
- Click OK; your table will be shown in the Output window.

Graphs

A frequency distribution graph can also be created using the Frequencies function. If you click on the Charts option in the Frequencies window (see Figure 1.11), a new window will open with chart options. Choose the Histograms option and click Continue. Then when you click OK, both your Table and your Graph will appear in the Output window. The graph will look like Figure 1.13. Notice that some additional descriptive statistics are also provided alongside the graph. We will discuss these statistics in the upcoming chapters.

SUMMARY OF FREQUENCY DISTRIBUTIONS

Frequency distribution tables and graphs are useful in helping summarize a distribution of scores. They allow you to see the shape of the distribution and clustering of scores in a particular part of the distribution. They can be created by hand, but Excel and SPSS can create them more easily for you, reducing the chance of error if your data have been entered into the program correctly. As we continue to discuss additional descriptive statistics in the next few chapters, you will see that these programs are quite useful in calculating your statistics.

STOP AND THINK

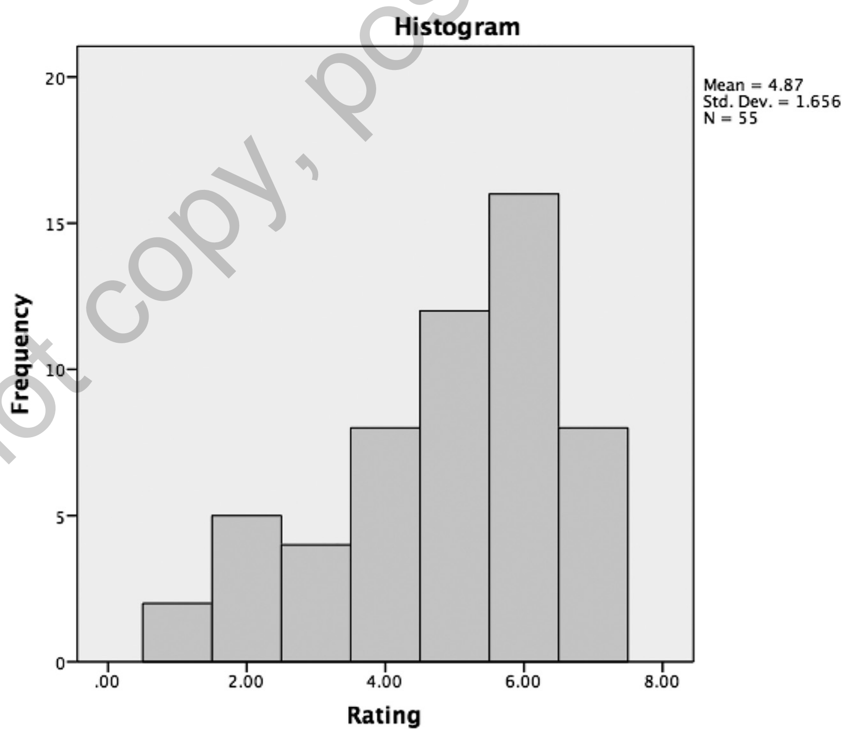
Create a frequency distribution graph in both Excel and SPSS for the following final exam scores according to letter grade groupings with 90%–100% = A, 80%–89% = B, 70%–79% = C, 60%–69% = D, below 60% = F:

83, 92, 100, 90, 74, 58, 84, 78, 85, 78, 72, 60, 67, 92, 92, 88, 88, 66, 60, 80, 88, 58, 92, 84, 84, 59, 80, 68, 78, 86, 76, 80, 64, 84, 68, 58, 72, 88, 89, 72, 88, 65, 80, 84, 68, 73, 92

1.8. Does this distribution appear to be symmetrical or skewed? If the shape is skewed, describe the skew (i.e., positive or negative skew).

1.9. About how many students received an A on the final? How many received a D or F?

FIGURE 1.13 ■ Frequency Distribution Graph in SPSS, Seen in the Output Window



THINKING ABOUT RESEARCH

A summary of a research study in psychology is given here. As you read the summary, think about the following questions:

1. What behaviors have the researchers observed?
2. How were the observations recorded by the researchers?
3. Were the researchers able to answer their research questions with the observations they collected? How?
4. Consider the graphs in Figure 1.14. Explain how these results address the researchers' question about behavior.
5. What are some examples of real-world behaviors that the results of this study might apply to?

Research Study. Strayer, D. L., & Johnston, W. A. (2001). Driven to distraction: Dual-task studies of simulated driving and conversing on a cellular phone. *Psychological Science, 12*, 462–466. [Note: Only Experiment 1 of this study is described.]

Purpose of the Study. The researchers were interested in how use of a cell phone while driving influences driving performance (see Photo 1.8). They describe previous studies that have shown that devices that require one's hands while driving (e.g., the radio, temperature controls) can reduce driving performance. In this study, they predicted that cell phone use would reduce driving performance. They tested two ideas about how cell phone use could decrease driving: (1) that the handheld use of the phone would interfere with driving and (2) that the attention requirements of a phone conversation would interfere with driving.

Method of the Study. Forty-eight undergraduates (half male, half female) participated in the experiment. Each of the students was randomly assigned to one of three cell phone conditions: handheld phone, hands-free phone, and no phone (radio control only). The participants performed a computer-simulated driving task where they moved the cursor on the screen to match a moving target as closely as possible, using a joystick. Red and green lights flashed periodically during the task, and subjects were instructed to press the "brake" button as quickly as possible when the red light flashed. They performed this task on its own in a practice segment and two test segments; a dual-task segment was placed between the two test segments. In the dual-task segment, they were given an additional task that included one of the following to match the conditions listed previously: handheld phone conversation with another person (who was part of the research team) about a current news story, hands-free phone conversation with another person about a current news story, or controlling a radio to listen to a broadcast of their choice. The frequency of missing red lights and the reaction time to hit the brake button when a red light appeared were measured and compared for the three phone conditions.


©istockphoto.com/goldy

Photo 1.8
Strayer and Johnston's (2001) study examined whether talking on a cell phone while driving decreases driving performance.

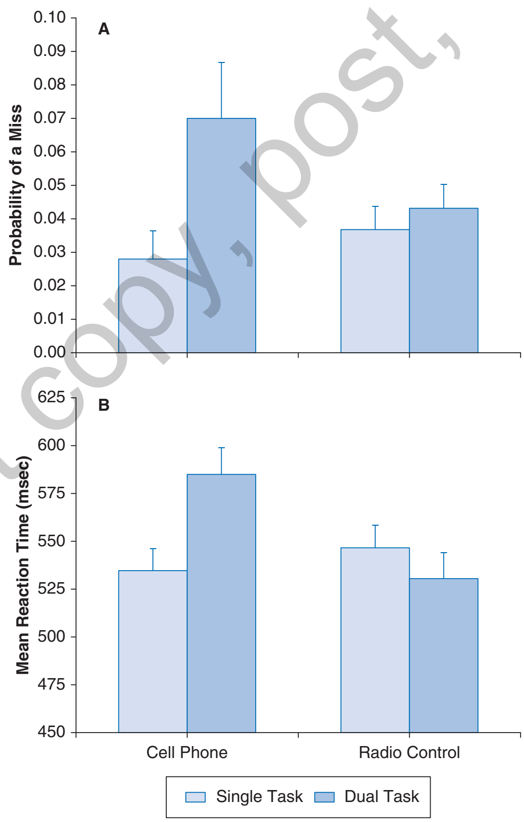
(Continued)

(Continued)

Results of the Study. The two cell phone use conditions did not differ in their results, suggesting that driving performance in response to red lights is similar for handheld and hands-free phone use. Figure 1.14 shows a graph for each of the measures according to the phone (combined for handheld and hands-free conditions) and no-phone conditions. The data are shown in each graph separately for driving performance in the driving only segments (single task) and for the phone or radio task while driving (dual-task) segment. The graphs show that more red lights were missed and time to press the brake button was longer when subjects were talking on the phone (compared with when only driving), but there was no difference in driving performance when subjects listened to the radio while driving and when they just performed the driving task on its own.

Conclusions of the Study. The authors concluded that phone use, regardless of whether it requires one's hands, interferes with driving performance more than just listening to the radio. This suggests that the attention component of phone use is the key factor in the driving performance interference.

FIGURE 1.14 ■ Driving Performance as Measured by Responses to Red Lights in the Driving Task While Performing the Driving Task on Its Own (Single Task) or While Also Performing the Phone or Radio Task (Dual Task)



Source: Strayer and Johnston (2001, Figure 1).

Chapter Summary

- **What is the value of research in psychology?**
  Research provides psychologists with new knowledge about behavior, regardless of the type of behavior of interest.
- **Why do psychologists conduct research?**
  Psychologists conduct research because it provides the best way to gain new knowledge about behavior.
- **What is the difference between a population and a sample?**
  A population is the group of individuals a researcher wants to learn about. The sample is the portion of the population that participates in the research study. This is the group of individuals observed by the researcher.
- **What kinds of data are collected in psychological studies?**
  Many different kinds of data are collected in research studies. Survey responses and systematic and controlled responses on a task are two common examples of the types of data researchers collect. Four measurement scales define the type of measurements used in the data collected: nominal, ordinal, interval, and ratio scales.
- **What is a distribution, and how does its shape affect our analysis of the data?**
  A distribution is a set of scores collected as data. The shape of a distribution can take many forms, but two common shapes are symmetrical and skewed shapes. These shapes will affect our choice of both descriptive and inferential statistics, as we will see in the coming chapters.

Applying Your Knowledge

On Facebook one day, you see a post from one of your friends that they have found the most amazing vitamin supplement. They claim that they have taken the vitamin once a day for the past few weeks, and they have more energy and feel great. They are passing on the information to their friends (including you) and urging you to try the vitamin for yourself.

- Why should you be skeptical of the claim you read from your friend?
- What other information would you want to have before deciding if you should try the new vitamin your friend is so excited about?
- Suppose you came across a news item reporting that thousands of people have been trying the new vitamin (they include interviews with some of these people) and that overall, these people have reported positive results. Would this convince you to try the new vitamin? Why or why not?

Test Yourself

1. Freud hypothesized that many of our personality traits are controlled by an unconscious conflict between aspects of ourselves—the id, ego, and superego—that we are not consciously aware of (Nairne, 2009). Using what you know about conducting research, explain why this hypothesis is difficult to support with observations of behavior.
2. The scientific method relies on which way of knowing information about the world?
3. If I am concerned about whether the survey I am using in my study accurately measures the behavior I am interested in, I am considering the ________________ of my study.
4. For each study description that follows, identify the most likely population of interest, identify the operational definition of the behavior of interest, and identify the scale of measurement of the dependent variable.
   a. College student participants were asked to play a virtual ball-tossing game during which some participants are systematically excluded from the game a short time after they began. The study tested the effects of social exclusion on the participants' mood. The researchers then asked the students to complete a mood survey in which they rated their mood on a 1 to 7 scale—higher numbers indicating a more positive mood.
   b. To examine the effect of diet on cognitive abilities, researchers taught rats to navigate a maze to reach a food reward. Half of the rats in the study were fed a special diet high in sugar; the other group of rats was fed the standard rat chow. The rats were then tested in the maze after being fed the assigned diet for 2 weeks. The amount of time it took the rats to reach the food reward in the maze was measured. Rats on the high-sugar diet took longer to run the maze on average than the normal diet rats.
   c. A study was conducted to examine the effects of violence on social behaviors in young children. Five-year-olds were asked to play a superhero video game with mild violence (e.g., punching, throwing). Two researchers who were not aware of the purpose of the study observed the children's behavior at recess. The number of social behaviors seen (e.g., helping another child, playing cooperatively with another child) was recorded on a school day both before and after they played the video game.
5. Providing responses on a survey to make yourself look better is called _________.
   a. symmetrical bias
   b. skewed bias
   c. social desirability bias
   d. ratio bias
6. In a research study on navigation, participants were asked to judge the distance of a landmark in the environment from their current location. This dependent variable was measured on a(n) _____________ measurement scale.
   a. nominal
   b. ordinal
   c. interval
   d. ratio

7. In a research study, you are asked to indicate your college major on a survey. This dependent variable was measured on a(n) ______________ measurement scale.
   a. nominal
   b. ordinal
   c. interval
   d. ratio
8. You are conducting a study that uses IQ tests. On these tests, the participants score an average of 100. All other scores are evenly distributed above and below this average. What type of distribution is this?
   a. Skewed distribution
   b. Symmetrical distribution
   c. Hypothetical distribution
   d. Faulty distribution
9. ____________ scales typically involve numerical scores, whereas ______________ scales do not.
   a. Interval, ratio
   b. Ratio, nominal
   c. Nominal, ordinal
   d. Ordinal, nominal
10. Survey data are always accurate.
    a. True
    b. False
11. A frequency distribution graph can show you the shape of a distribution.
    a. True
    b. False
12. Systematic and controlled measures are more direct observations of behavior than the self-reports collected on surveys.
    a. True
    b. False
13. Of the following choices, which are good operational definitions of anxiety?
    a. Scores on an anxiety scale
    b. Score on an exam
    c. A general feeling of helplessness
    d. Both a and c

SAGE edge™

Visit **edge.sagepub.com/mcbridermstats** to find the answers to the Test Yourself questions above, as well as quizzes, flashcards, and other resources to help you accomplish your coursework goals.