CHAPTER ONE

# PSYCHOLOGY, SCIENCE, AND LIFE

## CHAPTER OVERVIEW

LEARNING OBJECTIVES ■ KEY TERMS ■ CHAPTER PREVIEW



## LEARNING OBJECTIVES

**After going through this chapter, you will be able to:**

- Identify and describe the four basic goals of science
- Explain why falsifiability is important in scientific research
- Define the five different ways of knowing
- Explain the advantages of using the scientific approach to knowing
- Describe the importance of culture on approaches to knowledge
- Describe the four characteristics of scientific research
- Explain how science is driven by government, culture, and society
- Explain how researchers try to generalize from laboratory research to the natural world
- Differentiate between science and pseudoscience
- Identify the general characteristics of pseudoscience

**KEY TERMS**

Control, p. 12
Control of behavior, p. 12
Data driven, p. 7
Description, p. 10
Empirical approach, p. 7
Explanation, p. 10
Falsifiability, p. 11
Objective, p. 7
Peer review, p. 8
Prediction, p. 11
Pseudoscience, p. 17
Public, p. 8
Replicable, p. 8
Verifiable, p. 8

## CHAPTER PREVIEW

You probably know a great deal about people and some interesting and important facts about psychology, but you probably know relatively little about psychological research. This book will show you how research helps you learn more about people from a psychological point of view. You can be certain of one thing: There are no simple explanations.

When you read through this chapter, you will learn that there are different ways of knowing about behavior. As a beginning psychologist, you will get a glimpse about why some types of knowledge are more useful than others. In addition, you will see that people can be resistant to changing what they believe. For instance, a lot of people believe in ESP or other paranormal phenomena, even though the scientific evidence for it just isn't there. One reason for such beliefs is that most people don't approach life the same way that scientists do, so the evidence they accept is sometimes pretty shaky.

Finally, this chapter will introduce you to some of the cautions you should be aware of when you read about psychological research in the popular media. Journalists are not scientists and scientists are not journalists, so there is a lot of potential for miscommunication between the two.

## WHY ARE RESEARCH METHODS IMPORTANT TOOLS FOR LIFE?

The great thing about psychology is that people are both interesting and complicated, and we get to learn more about them. As you learn more, you will see that there can be a big difference between what we think we know about behavior and what is actually true. That is why you need this course—it will help you understand the world around you.

Your course on research begins the process of learning about how psychological knowledge emerges. This knowledge can be useful when applied to people's lives. For instance, even four years after a domestic terrorist destroyed a federal building in Oklahoma City, killing 168 people, about half the survivors were still suffering from some kind of psychiatric illness (North et al., 1999). This pattern mirrors the effects of the terrorist attacks in the United States in 2001, the devastation caused by a hurricane in Louisiana in 2005, and the experiences of many soldiers in combat in Iraq and Afghanistan, indicating the critical need to provide effective treatments (Humphreys, 2009).

We don't have to rely on such extreme examples of the use of psychological research. For example, scientists have suggested that some people suffer from addiction to indoor tanning (Zeller, Lazovich, Forster, & Widome, 2006), with some showing withdrawal symptoms when the researchers experimentally blocked the physiological effects

of tanning (Kaur et al., 2006). In the Controversy box on tanning addiction, you can see a psychological approach to investigating whether people can become addicted to tanning.

Another complex question relating to everyday life has involved something as seemingly noncontroversial as the *Baby Einstein* DVDs that purport to enhance language learning. Researchers have found that with increasing exposure to the *Baby Einstein* videos, language development actually slows down (Zimmerman, Christakis, & Meltzoff, 2007). In fact, Christakis (2009) has claimed that there is no experimental evidence indicating any advantages for language development in young infants. The developer of the videos makes the opposite claim. So how should we respond?

The only way to address such issues is to do research, which means that we need to create knowledge where it does not already exist. It might sound strange to think of "creating" knowledge, but that is exactly what happens in research. You end up with information that didn't exist before. This is one of the exciting parts of doing research: When you complete a study, you know something that nobody else in the world knows.

**CONTROVERSY:**

## On Tanning Addiction

Is it even reasonable to think that getting a tan might be an addiction? Isn't getting a tan just getting a tan? This is a question that we can address empirically. That is, we can collect data.

As noted before, Zeller et al. (2006) reported that adolescents find it difficult to stop their use of indoor tanning beds. What would you need to do to determine if tanning is an addiction? One approach is to see whether people engaging in this activity show the same orientation to it as do the people who are addicted to some substance, such as alcohol.

Clinicians diagnose addiction by asking whether alcohol users sometimes feel the need to reduce their alcohol consumption, whether people around them encourage them to quit drinking, whether they feel guilty about drinking, and whether they want to drink as soon as they awaken in the morning. When people respond yes to these questions, they could very well be addicted to alcohol.

What about asking related questions about tanning? Kourosh, Harrington, and Adinoff (2010) reported that investigators claim that up to 70 percent of frequent tanners respond that sometimes they think they should cut down on the frequency of tanning, that others annoy them about stopping, that they sometimes feel guilty about tanning, and that they want to do it when they get up in the morning. That is, frequent tanners respond to those questions in ways similar to alcoholics.

One mechanism for an addiction might be the physiological effect of exposure to ultraviolet light. Frequent tanners who had the choice between two tanning beds, one with UV exposure and one without, tended to select the one with UV exposure. Similarly, when the tanners received a drug that blocked the physiological effects of UV exposure, they showed withdrawal symptoms.

So tanning might become habitual not only because people think they look better with a tan but also because the UV light exerts a real biological effect with many of the characteristics associated with addiction to some drugs.

**Question for Discussion:** Researchers Martin and Petry (2005) have claimed that behaviors like excessive gambling or Internet use share clinical and biological elements with addiction to drugs and alcohol. Does it make sense to equate addictions to these behaviors to addictions to drugs?

## Why Research Is Important

In reading textbooks or journal articles, we might get the impression that we can carry out a research project and an explanation jumps clearly out of the results. In reality, there is always uncertainty in research. When we plan our investigations, we make many decisions about our procedures; when we examine our results, we usually have to puzzle through them before we are confident that we understand what we are looking at. In textbooks and journals, we only see the end product of ideas that have worked out successfully, and we do not see the twists and turns that led to those successes.

This course in research methods will also help you prepare for a possible future in psychology. If you attend graduate school, you will see that nearly all programs in psychology require an introductory psychology course, statistics, and research methods or experimental psychology. Your graduate school professors want you to know how psychologists think; research-based courses provide you with this knowledge. Those professors will provide courses that will help you learn the skills appropriate for your career. As a psychologist, you also need to understand the research process so you can read scientific journals, make sense of the research reports, and keep abreast of current ideas. Even if you don't choose a career as a researcher, you can still benefit from understanding research. Many jobs require knowledge of statistics and research.

In addition, every day you will be bombarded by claims that scientists have made breakthroughs in understanding various phenomena. It will be useful for you to be able to evaluate whether to believe what you hear. A course in research will help you learn how to think critically about the things people tell you. Is their research sound? Is the conclusion they draw the best one? Do they have something to gain from getting certain results? This process of critical thinking is a hallmark of science, but it is also a useful tool in everyday life.

## Answering Important Questions

There are many important scientific questions in need of answers. The journal *Science* (2005) listed what some scientists see as the top 25 questions that society needs to address. At least five of these are associated with issues that psychologists can help address:

- What is the biological basis of consciousness?
- How are memories stored and retrieved?
- How did cooperative behavior evolve?
- To what extent are genetic variation and personal health linked?
- Will the world's population outstrip the world's capability to accommodate 10 billion people?

These questions deal with behavior, either directly or indirectly. As such, psychologists will need to be involved in providing portions of the answers to each of these questions.

Of the next 100 important questions, 13 are psychological and behavioral, at least in part. These questions appear in Table 1.1, along with the areas of psychology to which they relate. As you can see, regardless of your specific interest in psychology, you will be able to find important questions to answer.

**TABLE 1.1 Psychological Questions Listed Among the Top Unanswered Questions in *Science* (2005) Magazine and the Areas of Psychology Associated with Them**

| Area of Psychology | Question |
|---|---|
| Social psychology | What are the roots of human culture? |
| Cognitive psychology | What are the evolutionary roots of language and music? |
| Biological bases of behavior/Cognitive psychology | Why do we sleep? |
| Personality/Learning | Why do we dream? |
| Biological bases of behavior | What synchronizes an organism's circadian clocks? |
| Comparative psychology/Learning | How do migrating organisms find their way? |
| Social psychology/Biological bases of behavior | What is the biological root of sexual orientation? |
| Abnormal psychology | What causes schizophrenia? |
| Developmental psychology | Why are there critical periods for language learning? |
| Personality theory/Biological bases of behavior | How much of personality is genetic? |
| Biological bases of behavior | Do pheromones influence human behavior? |
| Developmental psychology/Biological bases of behavior | What causes autism? |
| Personality theory | Is morality hardwired into the brain? |

Sometimes those questions hit very close to home. After Hurricane Katrina devastated New Orleans in 2005, people worked to reassemble their lives. Part of this task involved reopening businesses so that life could get back to normal. Researchers investigated some of the factors associated with businesses that resumed their work and discovered a notable psychological component. Family-owned businesses tended to open sooner than retail chains; in addition, if a business opened in a given location, neighboring businesses were likely to reopen as well (LeSage, 2011).

After you complete this course in research methods, you will be able to apply your new knowledge to areas outside of psychology. The research skills you pick up here will let you complete solid psychological research projects, and will also help you understand life better.

## SCIENTIFIC AND NONSCIENTIFIC KNOWLEDGE

There are still occasional debates about the scientific status of psychology. But to address this issue logically, we first need to establish what constitutes science. According to the National Academy of Science, science is actually a process, not a body of knowledge:

> Scientists gather information by observing the natural world and conducting experiments. They then propose how the systems being studied behave in general, basing their explanations on the data provided through their experiments and other observations. They test

> their explanations by conducting additional observations and experiments under different conditions. Other scientists confirm the observations independently and carry out additional studies that may lead to more sophisticated explanations and predictions about future observations and experiments. In these ways, scientists continually arrive at more accurate and more comprehensive explanations of particular aspects of nature. (National Academy of Sciences, 2008, p. 10)

If you take a look at any psychological research journal, you will clearly see that psychologists conduct experiments, generate explanations, confirm their findings, and strive to make their conclusions as comprehensive and as accurate as possible.

**Tenacity**—The mode of accepting knowledge because one is comfortable with it and simply wants to hold onto it.

**Authority**—The mode of accepting knowledge because a person in a position of authority claims that something is true or valid.

**A Priori Method**—The mode of accepting knowledge based on a premise that people have agreed on, followed by reasoned argument.

**Scientific Approach**—The mode of accepting knowledge based on empirically derived data.

In addition, Boyack, Klavans, & Börner (2005) have identified so-called "hub sciences" around which other disciplines hover. They assessed a million articles from 7,121 natural and social science journals published in the year 2000 to see what areas influenced or were influenced by other areas. The authors found that there were seven hub sciences that were cited by the other sciences: mathematics, physics, chemistry, earth sciences, medicine, psychology, and the social sciences.

An important question about knowledge is how we acquire it. Obviously, scientific knowledge is one means, but it is not the only way that people deal with what they know. There are different paths to factual knowledge in our lives. We will see that not all roads to knowledge are equally useful. The nineteenth-century American philosopher Charles Sanders Peirce (1877) identified several ways of knowing, which he called **tenacity**, **authority**, the **a priori method**, and the **scientific approach**. He concluded that the best approach was the scientific approach.

Tenacity involves simply believing something because you don't want to give up your belief. People do this all the time; you have probably discovered that it can be difficult to convince people to change their minds. However, if two people hold mutually contradictory beliefs, both cannot be true. According to Peirce, in a "saner moment," we might recognize that others have valid points, which can shake our own beliefs.

An alternative to an individual's belief in what is true, Peirce thought, could reside in what authorities say is true. This approach removes the burden from any single person to make decisions; instead, one would rely on an expert of some kind. Peirce talked about authorities who would force beliefs under threat of some kind of penalty, but we can generalize to any acceptance of knowledge because somebody whom we trust says something is true. As Peirce noted, though, experts with different perspectives will hold different beliefs. How is one to know which expert is actually right?

**Experience**—A way of knowing that uses personal experience as the means of deciding what is true about behavior.

He then suggested that people might fix their knowledge based on consensus and reasoned argument, the *a priori* approach. The problem here, he wrote, was that reasons for believing something may change over time, so what was seen as true in the past may change. Later thinkers have added **experience** as contributing to knowledge, but different people have different experiences, which can lead to different versions of "the truth". So experience is limited in its utility.

If we want to know universal truths, he reasoned, the most valid approach is through science, which is objective and self-correcting. Gradually, we can accumulate knowledge that is valid and discard ideas that prove to be wrong.

## CHARACTERISTICS OF SCIENCE

### Science Is Objective

What does it mean for our observations to be **objective**? One implication is that we define clearly the concepts we are dealing with. This is often easier said than done. Psychologists deal with complex and abstract concepts that are hard to measure. Nonetheless, we have to develop some way to measure these concepts in clear and systematic ways. For example, suppose we want to find out whether we respond more positively to attractive people than to others.

**Objective**— Measurements that are not affected by personal bias and are well defined and specified are considered objective.

To answer our question, we first have to define what we mean by "attractive." The definition must be objective; that is, the definition has to be consistent, clear, and understandable, even though it may not be perfect.

Researchers have taken various routes to creating objective definitions of attractiveness. Wilson (1978) simply mentioned that "a female confederate . . . appearing either attractive or unattractive asked in a neutral manner for directions to a particular building on central campus at a large Midwestern University" (p. 313). This vague statement doesn't really tell us as much as we would like to know. We don't have a clear definition of what the researchers meant by attractiveness. Juhnke et al. (1987) varied the attire of people who seemed to be in need of help. The researchers defined attractiveness based on clothing. Unattractive people, that is, those wearing less desirable clothing, received help, even though they did not look very attractive. On the other hand, Bull and Stevens (1980) used helpers with either good or bad teeth in defining attractive and unattractive.

If the different research teams did not report how they created an unattractive appearance, we would have a harder time evaluating their research and repeating it exactly as they did it. It may be very important to know what manipulation the researchers used. Differences in attractiveness due to the kinds of clothes you are wearing may not lead to the same reactions as differences due to unsightly teeth.

**Data Driven**— Interpretations of research that are based on objective results of a project are considered data driven.

### Science Is Data Driven

Our conclusions as scientists must also be **data driven**. This simply means that our conclusions must follow logically from our data. There may be several equally good interpretations from a single set of data. Regardless of which interpretation we choose, it has to be based on the data we collect.

**Empirical Approach**— The method of discovery that relies on systematic observation and data collection for guidance on drawing conclusions.

To say that science is based on data is to say that it is **empirical**. Empiricism refers to the method of discovery that relies on systematic observation and data for drawing conclusions. Psychology is an empirical discipline in that knowledge is based on the results of research, that is, on data.

The critical point here is that if we are to develop a more complete and accurate understanding of the world around us, scientific knowledge based on data will, in the long run, serve us better than intuition alone. Don't discount intuition entirely; quite a few scientific insights had their beginnings in intuitions that were scientifically studied and found to be true. We just can't rely entirely on intuition because it differs across people and may change over time.

## Science Is Replicable and Verifiable

Our scientific knowledge has to be potentially **replicable** and **verifiable**. This means that others should have the opportunity to repeat a research project to see if the same results occur each time. Maybe the researchers who are trying to repeat the study will generate the same result; maybe they will not. We do not claim that *results* are scientific; rather, we claim that the *approach* is scientific. Any time somebody makes a claim but will not let others verify it as valid, we should be skeptical.

**Replicable**—When scientists can recreate a previous research study, that study is replicable.

Why should one scientist repeat somebody else's research? As it turns out, there is a bias among journal editors to publish findings that show differences across groups and to reject studies showing no differences. So a relatively large number of research reports may describe differences that occurred accidentally. That is, groups may differ, but not for any systematic or reproducible reason. If the researcher were to repeat the study, a different result would occur.

**Verifiable**—When scientists can reproduce a previous research study and generate the same results, it is verifiable.

Ioannidis (2005), referring to genetic and biomedical research, noted that "there is increasing concern that in modern research, false findings may be the majority or even the vast majority of published research claims" (p. 696)*. His conclusion comes, in part, from a recognition that journal editors and researchers are more impressed by findings that show that something interesting occurred but not by findings that do not reveal interesting patterns. Ioannidis's speculation may be true for psychological research, just as it is for biologically based studies.

**Public**—Scientists make their research public, typically by making presentations at conferences or by publishing their work in journals or books.

Psychologists have recognized this problem for quite some time (e.g., Rosenthal, 1979). Fortunately, when a research project is repeated and the same outcome results, our confidence in the results increases markedly (Moonesinghe, Khoury, & Janssens, 2007). The reason that replication of research is such a good idea is that it helps us to weed out findings that turn out to be false and to strengthen our confidence in findings that are valid.

**Peer Review**—A process in which researchers submit their research for publication in a journal or present their research at a conference to other experts in the field who evaluate the research.

## Science Is Public

When we say that our research is ***public***, we mean this literally. Scientists only recognize research as valid or useful when they can scrutinize it. Generally, we accept research as valid if it has undergone ***peer review***. For instance, when a psychologist completes research, often the next step is to write the results in a scientific manuscript and submit it for publication in a research journal.

* Ioannidis JPA (2005) Why Most Published Research Findings Are False. *PLoS Med* 2(8): e124. doi:10.1371/journal.pmed.0020124

The editor of the journal will send the manuscript to experts in the field for their comments. If the editor and the reviewers agree that major problems have been taken care of, the article will appear in the journal. Otherwise, the article will be rejected. Among major journals in psychology, only about a quarter or fewer of all manuscripts that researchers submit are published.

Another approach to making our research public involves submitting a proposal to a research conference for a presentation. The process for acceptance to a conference resembles that for acceptance by a journal. In some cases, researchers may initially present their ideas at a conference, then follow up with a published article.

## CULTURE AND DIFFERENT WAYS OF KNOWING

In the United States and Europe, we are used to thinking in certain ways. For instance, it is not unusual for people in the West to regard a fact as either true or false. That is, we create dichotomies. When we engage in research, we try to find the single correct answer to our question. Although we accept this approach as normal and appropriate, there are other approaches to knowledge that have as much validity to them as the Western approach.

For example, Eastern people are more willing to accept two contradictory statements as each having truth to them, whereas Western people prefer to accept a single truth when confronted with contradictions (Nisbett, Peng, Choi, & Norenzayan, 2001). In addition, the ways that people organize their world differ according to cultural orientation. For instance, when people in the West select two related words from triads like *monkey–panda–banana*, they tend to group the words functionally (i.e., *monkey–panda*), whereas people in the East use relational groupings (i.e., *monkey–banana*) (Ji, Zhang, & Nisbett, 2004).

These differences in approaches have distinct relevance regarding both the creation and the interpretation of research. In the past, Western researchers simply imported their methodologies to new cultures, asking research questions that might not have been particularly meaningful to people in those cultures. Fortunately, psychologists have become more aware that awareness of culture is a prerequisite to good research.

## WHY WE DO RESEARCH

People are curious, social beings. As a result, most of us are interested in what others are up to and why. By the time you read this book, you have been observing others since childhood. You have probably become a sophisticated observer of others' behaviors and can predict pretty well how your friends will react if you act a certain way, at least some of the time. How did you gain this knowledge? Throughout your life, you have done things and then you observed the effect you had on others. Although you probably have not gone through life wearing the stereotypical white lab coat worn by some scientists, you have acted like a scientist when you discovered that "When I do this, they do that." One of the differences between scientific and nonscientific observation, though, is that scientists develop systematic plans, and we work to reduce bias in recording observations. In the end, though, curiosity and enjoyment in finding out about behavior underlies the reason why researchers do their work–they think it is fun.

As curious scientists, we generally work toward four goals based on our observations: description, explanation, prediction, and control of behavior.

## Description

Our tendency to act and then to observe others' reactions fulfills what seems to be a basic need for us: describing the world around us. In fact, when you can **describe** events around you, you have taken the first step in scientific discovery. In research, description involves a systematic approach to observing behavior.

**Description**—A goal of science in which behaviors are systematically and accurately characterized.

In your course on behavioral research, you will learn how, as scientists, we systematically begin to understand why people act as they do. The biggest difference between what you do in your everyday observations and what scientists do is that scientists pay attention to a lot of details that we normally think of as unimportant. Unlike most of us in everyday, casual observation, researchers develop a systematic plan for making objective observations so we can generate complete and accurate descriptions.

## Explanation

This leads to another goal of science, **explanation**. When we truly understand the causes of behavior, we can explain them. This is where theory comes in. A **theory** helps us understand behavior in a general sense. In scientific use, a theory is a general, organizing principle. When we have enough relevant information about behavior, we can develop an explanatory framework that puts all of that information into a nice, neat package—that is, into a theory. Thus, to say that evolution is a theory means that it is the best set of ideas to explain biological phenomena. In everyday life, people often use the word *theory* when they mean ***hypothesis*** that scientists pose as expectations regarding the results of their research. So if a person says that evolution is only a theory, that person probably has a misunderstanding about what scientific theory really is.

**Explanation**—A goal of science in which a researcher achieves awareness of why behaviors occur as they do.

**Theory**—An set of interrelated concepts that scientists use to organize concepts and explain natural phenomena.

**Hypothesis**—A testable prediction regarding the empirical outcome of research

In order to develop a theory, we look at the facts that we believe to be true and try to develop a coherent framework that links the facts to one another. The next step is to test the theory to see if it successfully predicts the results of new research. So we generate hypotheses, which are educated guesses, about behaviors, and we test those hypotheses with research. The research shows us whether our hypotheses are correct; if so, the theory receives further support.

If enough of our hypotheses support a theory, we regard it as more useful in understanding why people act in a certain way; if those hypotheses do not support the theory, we need to revise or abandon the theory. When we conduct research, we should have an open mind about an issue; we might have preconceived ideas of what to expect, but if we are wrong, we should be willing to change our beliefs.

When we test hypotheses, we make them objective and testable. This means that we define our terms clearly so others know exactly what we mean, and we specify how our