Fifth Edition

Research Methods and Statistics

A CRITICAL THINKING APPROACH

Sherri L. Jackson

FIFTH EDITION

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A Critical Thinking Approach

Sherri L. Jackson

Jacksonville University

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To all my furry muses past and present,
Bennie, Henry, and Percy

About the Author

Sherri L. Jackson is professor of psychology at Jacksonville University, where she has taught since 1988. At JU, she has won Excellence in Scholarship (2003), University Service (2004), and Teaching (2009) awards, the university-wide Professor of the Year Award in 2004, the Woman of the Year Award in 2005, and the Institutional Excellence Award in 2007. She received her B.A. from North Adams State College and her M.S. and Ph.D. in cognitive/experimental psychology from the University of Florida. Her research interests include human reasoning and the teaching of psychology. She has published numerous articles in both areas. She is also the author of *Statistics Plain and Simple*, 3rd edition (Belmont, CA: Cengage, 2014), *Research Methods: A Modular Approach*, 3rd edition (Belmont, CA: Cengage, 2015), and *A Concise Guide to Statistical Analyses Using Excel, SPSS, and the TI-84 Calculator* (Belmont, CA: Cengage, 2013). She currently serves as Chair of the Division of Social Sciences.

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Preface

When I first began teaching research methods 26 years ago, I did not include statistics in my class because my students took a separate statistics course as a prerequisite. However, as time passed, I began to integrate more and more statistical content so that students could understand more fully how methods and statistics relate to one another. Eventually I reached the point where I decided to adopt a textbook that integrated statistics and research methods. However, I was somewhat surprised to find that there were only a few integrated texts. In addition, these texts covered statistics in much greater detail than I needed or wanted. Thus, I wrote the present text to meet the market need for a brief, introductory-level, integrated text. My other writing goals were to be *concise yet comprehensive,* to use an *organization* that progresses for the most part from nonexperimental methods to experimental methods, to incorporate *critical thinking* throughout the text, and to use a simple, easy-to-understand *writing style.*

Concise yet Comprehensive

The present text is concise (it can be covered in a one-semester course if necessary, and if paired with supplements, can easily fit a two-semester course) yet still integrates statistics with methods. To accomplish these twin goals, I chose to cover only those statistics most used by psychologists rather than to include all the statistics that might be covered in a regular statistics class. The result is a text that, in effect, integrates a statistical supplement within a methods text. The advantage of using this text rather than a statistical supplement with a methods text is that the statistics are integrated throughout the text. In other words, I have described the statistics that would be used with a particular research method in the same chapter or in a chapter immediately following the pertinent methods chapter.

I realize that some instructors may like the integrated approach but not want to cover inferential statistics in as much detail as I do. I have therefore structured the coverage of each inferential statistical test so that the calculations may be omitted if so desired. I have divided the section on each statistical test into four clear subsections. The first describes the statistical test and what it does for a researcher. The second subsection provides the formulas for the test and an example of how to apply the formulas. In the third subsection, I demonstrate how to interpret the results from the test; and in the final subsection, I list the assumptions that underlie the test. Instructors who simply want their students to understand the test, how to interpret it, and the assumptions behind it can omit (not assign) the subsection

on statistical calculations without any problems of continuity. Thus, the text is appropriate both in methods classes for which statistics is not a prerequisite and in those classes for which statistics is a prerequisite. In the latter case, the calculation subsections may be omitted, or they may be used as a statistical review and as a means of demonstrating how statistics are used by psychologists.

Organization

The text begins with chapters on science and getting started in research (Chapters 1 and 2). Measurement issues and descriptive methods and statistics are then covered, followed by correlational methods and statistics (Chapters 3 to 6). Probabliity, hypothesis testing, and inferential statistics are introduced in Chapters 7 and 8, followed by experimental design and the appropriate inferential statistics for analyzing such designs (Chapters 9 to 12 and 14). The remaining two chapters present quasi-experimental and single-case designs (Chapter 13) and APA guidelines on writing (Chapter 15).

Critical Thinking

Evaluation of any research design involves critical thinking, so this particular goal is not a novel one in research methods texts. However, I have made a special effort to incorporate a critical thinking mind-set into the text in the hopes of fostering this in students. I attempt to teach students to adopt a skeptical approach to research analysis through instructive examples and an explicit pedagogical aid incorporated within the text. At the end of each major section in each chapter, I have inserted a *Critical Thinking Check.* This feature varies in length and format but generally involves a series of application questions concerning the section information. The questions are designed to foster analytical/critical thinking skills in addition to reviewing the section information.

Writing Style

I present the information in a simple, direct, easy-to-understand fashion. Because research methods is one of the more difficult courses for students, I also try to write in an engaging, conversational style, much as if the reader were a student seated in front of me in my classroom. I hope, through this writing style, to help students better understand some of the more troublesome concepts without losing their interest.

Pedagogical Aids

The text incorporates several pedagogical aids at the chapter level. Each chapter begins with a *chapter outline,* which is followed by *learning objectives.* Key terms are defined in a *running glossary* in the margins within each chapter. *In Review* summary matrices, at the end of major sections in each chapter, provide a review of the major concepts of the section in a tabular format. These summaries are immediately followed by the *Critical Thinking Checks* described previously. Thus, students can use the In Review summary after reading a chapter section and then engage in the Critical Thinking Check on that information. *Chapter Exercises* are provided at the end of each chapter so that students can further review and apply the knowledge in that chapter. Answers to the odd-numbered chapter exercises are provided in Appendix C. *Answers to the Critical Thinking Checks* appear at the end of each chapter. As in the previous edition, the Study Guide has been incorporated into the text in this edition so there is no additional cost to the student. The built-in Study Guide appears at the end of each chapter and includes a *chapter summary, fill-in questions, multiple-choice questions,* and *extra problems* for chapters with statistics.

New to This Edition

The fifth edition contains 15 chapters, as did the previous edition. However, several of the chapters have been reorganized and new information has been added. Chapters 9 and 10 have been reorganized so an experimental design and the parametric statistic appropriate for that design are covered in the same chapter. Thus, Chapter 9 introduces simple between-subjects designs and the parametric statistic appropriate to analyze the data from this design. Chapter 10 does the same for correlated-groups designs. The new Chapter 14 covers nonparametric statistics, including new coverage of two advanced nonparametric statistics: the Kruskal-Wallis test and the Friedman test. Chapter 15 covers APA manuscript guidelines according to the 6th edition of the publication manual, and the APA sample paper has been moved to an appendix.

In addition, more recent research examples have been added throughout the text, and full coverage of how to use Excel, SPSS, and the TI-84 calculator to perform statistical analyses has been added to the end of each chapter in which statistics are covered (Chapters 5, 6, 8, 9, 10, 11, 12, and 14) in the Statistical Software Resource section at the end of these chapters.

For the Instructor

An *Instructor's Manual/Test Bank* accompanies the text. The *Instructor's Manual* contains lecture outlines, PowerPoint slides of most of the tables and figures from the text, resources to aid in the development of classroom exercises/demonstrations, and answers to all chapter exercises. A test bank includes multiple-choice, short-answer, and essay questions.

For the Student

In addition to the pedagogical aids built into the text, Web resources include glossaries and flashcards at CengageBrain.com.

Acknowledgments

I must acknowledge many people for their help with this project. I thank the students in my research methods classes on which the text was pretested. Their comments were most valuable. I also thank my husband for his careful proofreading and insightful comments, and Percy for the encouragement of her ever-present wagging tail. In addition, I would like to thank those who reviewed the text in the first through fifth editions. They include Patrick Ament, Central Missouri State University; Michele Breault, Truman State University; Stephen Levine, Georgian Court College; Patrick McKnight, University of Arizona; William Moyer, Millersville University; Michael Politano, The Citadel; Jeff Smith, Northern Kentucky University; Bart Van Voorhis, University of Wisconsin, LaCrosse; Zoe Warwick, University of Maryland, Baltimore County; and Carolyn Weisz, University of Puget Sound; Scott Bailey, Texas Lutheran University; James Ballard, California State University, Northridge; Stephen Blessing, University of Tampa; Amy Bohmann, Texas Lutheran University; Anne Cook, University of Utah; Julie Evey, University of Southern Indiana; Rob Mowrer, Angelo State University; Sandra Nicks, Christian Brothers University; Clare Porac, Pennsylvania State University, Erie, The Behrend College; and Diane Winn, Colby College. In this third edition, I was fortunate again to have reviewers who took their task seriously and provided very constructive suggestions for strengthening and improving the text. I am grateful for the suggestions and comments provided by Martin Bink, Western Kentucky University; David Falcone, La Salle University; Tiara Falcone, The College of New Jersey; Cary S. Feria, Morehead State University; Greg Galardi, Peru State College; Natalie Gasson, Curtin University; Brian Johnson, University of Tennessee at Martin; Maya Khanna, Creighton University; David Kreiner, University of Central Missouri; Martha Mann, University of Texas at Arlington; Benjamin Miller, Salem State College; Erin Murdoch, University of Central Florida; Mary Nebus, Georgian Court University; Michael Politano, The Citadel; and Linda Rueckert, Northeastern Illinois University.

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Sherri L. Jackson

CHAPTER 1

Thinking Like a Scientist

Areas of Psychological Research
Psychobiology
Cognition
Human Development
Social Psychology
Psychotherapy

Sources of Knowledge
Superstition and Intuition
Authority
Tenacity
Rationalism
Empiricism
Science

The Scientific (Critical Thinking) Approach and Psychology
Systematic Empiricism
Publicly Verifiable Knowledge
Empirically Solvable Problems

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Goals of Science
Description
Prediction
Explanation

An Introduction to Research Methods in Science
Descriptive Methods
Predictive (Relational) Methods
Explanatory Method

Doing Science
Proof and Disproof
The Research Process
Summary
Key Terms
Chapter Exercises
Critical Thinking Check Answers
Web Resources
Chapter 1 Study Guide

Learning Objectives

- Identify and describe the areas of psychological research.
- Identify and differentiate between the various sources of knowledge.
- Describe the three criteria of the scientific (critical thinking) approach.
- Explain the difference between basic and applied research.
- Explain the goals of science.
- Identify and compare descriptive methods.
- Identify and compare predictive (relational) methods.
- Describe the explanatory method. Your description should include independent variable, dependent variable, control group, and experimental group.
- Explain how we "do" science and how proof and disproof relate to doing science.

Welcome to what is most likely your first research methods class. If you are like most psychology students, you are probably wondering what in the world this class is about—and, more important, why you have to take it. Most psychologists and the American Psychological Association (APA) consider the research methods class especially important in the undergraduate curriculum. In fact, along with the introductory psychology class, the research methods class is one of the courses required by most psychology departments (Messer, Griggs, & Jackson, 1999). Why is this class considered so important, and what exactly is it all about?

Before answering these questions, I will ask you to complete a couple of exercises related to your knowledge of psychology. I usually begin my research methods class by asking my students to do these exercises. I assume that you have had at least one other psychology class prior to this one. Thus, these exercises should not be too difficult.

Exercise 1: Try to name five psychologists. Make sure that your list does not include any "pop" psychologists such as Dr. Ruth or Dr. Laura. These individuals are considered by most psychologists to be "pop" psychologists because, although they are certified to do some sort of counseling, neither actually completed a degree in psychology. Dr. Ruth has an Ed.D. in the interdisciplinary study of the family, and Dr. Laura has a Ph.D. in physiology and a postdoctoral certification in marriage, family, and child counseling.

Okay, whom did you name first? If you are like most people, you named Sigmund Freud. In fact, if we were to stop 100 people on the street and ask the same question of them, we would probably find that, other than "pop" psychologists, Freud would be the most commonly named psychologist (Stanovich, 2007). What do you know about Freud? Do you believe that he is representative of all that psychology encompasses? Most people on the

street believe so. In fact, most of them believe that psychologists "do" what they see "pop" psychologists doing and what they believe Freud did. That is, they believe that most psychologists listen to people's problems and try to help them solve those problems. If this represents your schema for psychology, this class should help you to see the discipline in a very different light.

Exercise 2 (taken from Bolt, 1998): Make two columns on a piece of paper, one labeled "Scientist" and one labeled "Psychologist." Now, write five descriptive terms for each. You may include terms or phrases that describe what you believe the "typical" scientist or psychologist looks like, dresses like, or acts like, as well as what personality characteristics you believe these individuals have. After you have finished this task, evaluate your descriptions. Do they differ? Again, if you are like most students, even psychology majors, you have probably written very different terms to describe each of these categories.

First, consider your descriptions of a scientist. Most students see the scientist as a middle-aged man, usually wearing a white lab coat with a pocket protector on it. The terms for the scientist's personality usually describe someone who is analytical, committed, and introverted with poor people/social skills. Are any of these similar to your descriptions?

Now let's turn to your descriptions of a typical psychologist. Once again, a majority of students tend to picture a man, although some picture a woman. They definitely do not see the psychologist in a white lab coat but instead in some sort of professional attire. The terms for personality characteristics tend to describe someone who is warm, caring, empathic, and concerned about others. Does this sound similar to what you have written?

What is the point behind these exercises? First, they illustrate that most people have misconceptions about what psychologists do and about what psychology is. In other words, most people believe that the majority of psychologists do what Freud did—try to help others with their problems. They also tend to see psychology as a discipline devoted to the mental health profession. As you will soon see, psychology includes many other areas of specialization, some of which may actually involve wearing a white lab coat and working with technical equipment.

I asked you to describe a scientist versus a psychologist because I hoped that you would begin to realize that a psychologist *is* a scientist. Wait a minute, you may be saying. I decided to major in psychology because I don't like science. What you have failed to recognize is that what makes something a science is not *what* is studied but *how* it is studied. This is what you will be learning about in this course—how to use the scientific method to conduct research in psychology. This is also why you may have had to take statistics as a prerequisite or corequisite to this class and why statistics are covered in this text—because doing research requires an understanding of how to use statistics. In this text, you will learn about both research methods and the statistics most useful for these methods.

Areas of Psychological Research

As we noted, psychology is not just about mental health. Psychology is a very diverse discipline that encompasses many areas of study. To illustrate this, examine Table 1.1, which lists the divisions of the American Psychological Association (APA). You will notice that the areas of study within psychology range from those that are closer to the so-called "hard" sciences (chemistry, physics, biology) to those that are closer to the so-called "soft" social sciences (sociology, anthropology, political science). The APA has 54 divisions, each representing an area of research or practice. To understand what psychology is, it is important that you have an appreciation of its diversity. In the following sections, we will briefly discuss some of the more popular research areas within the discipline of psychology.

TABLE 1.1 Divisions of the American Psychological Association

1. Society for General Psychology
2. Society for the Teaching of Psychology
3. Experimental Psychology
5. Evaluation, Measurement, and Statistics
6. Behavioral Neuroscience and Comparative Psychology
7. Developmental Psychology
8. Society for Personality and Social Psychology
9. Society for Psychological Study of Social Issues
10. Society for the Psychology of Aesthetics, Creativity, and the Arts
12. Society for Clinical Psychology
13. Society for Consulting Psychology
14. Society for Industrial and Organizational Psychology
15. Educational Psychology
16. School Psychology
17. Society for Counseling Psychology
18. Psychologists in Public Service
19. Society for Military Psychology
20. Adult Development and Aging
21. Applied Experimental and Engineering Psychology
22. Rehabilitation Psychology
23. Society for Consumer Psychology

(*continued*)

TABLE 1.1 Divisions of the American Psychological Association (*continued*)

24. Society for Theoretical and Philosophical Psychology
25. Behavior Analysis
26. Society for the History of Psychology
27. Society for Community Research and Action: Division of Community Psychology
28. Psychopharmacology and Substance Abuse
29. Psychotherapy
30. Society for Psychological Hypnosis
31. State, Provincial, and Territorial Psychological Association Affairs
32. Society for Humanistic Psychology
33. Intellectual and Developmental Disabilities
34. Society for Environmental, Population, and Conservation Psychology
35. Society for the Psychology of Women
36. Psychology of Religion and Spirituality
37. Society for Child and Family Policy and Practice
38. Health Psychology
39. Psychoanalysis
40. Clinical Neuropsychology
41. American Psychology-Law Society
42. Psychologists in Independent Practice
43. Society for Family Psychology
44. Society for the Psychological Study of Lesbian, Gay, Bisexual, and Transgender Issues
45. Society for the Psychological Study of Ethnic and Minority Issues
46. Media Psychology
47. Exercise and Sport Psychology
48. Society for the Study of Peace, Conflict, and Violence: Peace Psychology Division
49. Society of Group Psychology and Group Psychotherapy
50. Society of Addiction Psychology
51. Society for the Psychological Study of Men and Masculinity
52. International Psychology
53. Society of Clinical Child and Adolescent Psychology
54. Society of Pediatric Psychology
55. American Society for the Advancement of Pharmacotherapy
56. Trauma Psychology

NOTE: There is no Division 4 or 11.

Psychobiology

One of the most popular research areas in psychology today is psychobiology. As the name implies, this research area combines biology and psychology. Researchers in this area typically study brain organization or the chemicals within the brain (neurotransmitters). Using the appropriate research methods, psychobiologists have discovered links between illnesses such as schizophrenia and Parkinson's disease and various neurotransmitters in the brain—leading, in turn, to research on possible drug therapies for these illnesses.

Cognition

Researchers who study cognition are interested in how humans process, store, and retrieve information; solve problems; use reasoning and logic; make decisions; and use language. Understanding and employing the appropriate research methods have enabled scientists in these areas to develop models of how memory works, ways to improve memory, methods to improve problem solving and intelligence, and theories of language acquisition. Whereas psychobiology researchers study the brain, cognitive scientists study the mind.

Human Development

Psychologists in this area conduct research on the physical, social, and cognitive development of humans. This might involve research from the prenatal development period throughout the life span to research on the elderly (gerontology). Research on human development has led, for example, to better understanding of prenatal development and hence better prenatal care, knowledge of cognitive development and cognitive limitations in children, and greater awareness of the effects of peer pressure on adolescents.

Social Psychology

Social psychologists are interested in how we view and affect one another. Research in this area combines the disciplines of psychology and sociology, in that social psychologists are typically interested in how being part of a group affects the individual. Some of the best-known studies in psychology represent work by social psychologists. For example, Milgram's (1963, 1974) classic experiments on obedience to authority and Zimbardo's (1972) classic prison simulation are social psychology studies.

Psychotherapy

Psychologists also conduct research that attempts to evaluate psychotherapies. Research on psychotherapies is designed to assess whether a therapy is effective in helping individuals. Might patients have improved without the therapy, or did they improve simply because they thought the therapy

was supposed to help? Given the widespread use of various therapies, it is important to have an estimate of their effectiveness.

Sources of Knowledge

There are many ways to gain knowledge, and some are better than others. As scientists, psychologists must be aware of each of these methods. Let's look at several ways of acquiring knowledge, beginning with sources that may not be as reliable or accurate as scientists might desire. We will then consider sources that offer greater reliability and will ultimately discuss using science as a means of gaining knowledge.

Superstition and Intuition

knowledge via superstition
Knowledge that is based on subjective feelings, interpreting random events as nonrandom events, or believing in magical events.

Gaining **knowledge via superstition** means acquiring knowledge that is based on subjective feelings, interpreting random events as nonrandom events, or believing in magical events. For example, you may have heard someone say "Bad things happen in threes." Where does this idea come from? As far as I know, no study has ever documented that bad events occur in threes, yet people frequently say this and act as if they believe it. Some people believe that breaking a mirror brings 7 years of bad luck or that the number 13 is unlucky. Once again, these are examples of superstitious beliefs that are not based on observation or hypothesis testing. As such, they represent a means of gaining knowledge that is neither reliable nor valid.

knowledge via intuition
Knowledge gained without being consciously aware of its source.

When we gain **knowledge via intuition**, it means that we have knowledge of something without being consciously aware of where the knowledge came from. You have probably heard people say things like "I don't know, it's just a gut feeling" or "I don't know, it just came to me, and I know it's true." These statements represent examples of intuition. However, sometimes we intuit something based not on a "gut feeling" but on events we have observed. The problem is that the events may be misinterpreted and not representative of all events in that category. For example, many people believe that more babies are born during a full moon or that couples who have adopted a baby are more likely to conceive after the adoption. These are examples of *illusory correlation*—the perception of a relationship that does not exist. More babies are not born when the moon is full nor are couples more likely to conceive after adopting (Gilovich, 1991). Instead, we are more likely to notice and pay attention to those couples who conceive after adopting and not notice those who did not conceive after adopting.

Authority

knowledge via authority
Knowledge gained from those viewed as authority figures.

When we accept what a respected or famous person tells us, we are gaining **knowledge via authority**. You may have gained much of your own knowledge through authority figures. As you were growing up, your parents provided you with information that, for the most part, you did not question,

especially when you were very young. You believed that they knew what they were talking about, and thus you accepted the answers they gave you. You have probably also gained knowledge from teachers whom you viewed as authority figures, at times blindly accepting what they said as truth. Most people tend to accept information imparted by those they view as authority figures. Historically, authority figures have been a primary means of information. For example, in some time periods and cultures, the church and its leaders were responsible for providing much of the knowledge that individuals gained throughout the course of their lives.

Even today, many individuals gain much of their knowledge from authority figures. This may not be a problem if the perceived authority figure truly is an authority on the subject. However, problems may arise in situations where the perceived authority figure really is not knowledgeable about the material he or she is imparting. A good example is the information given in "infomercials." Celebrities are often used to deliver the message or a testimonial concerning a product. For example, Cindy Crawford may tell us about a makeup product, or Jessica Simpson may provide a testimonial regarding a an acne product. Do Cindy Crawford or Jessica Simpson have degrees in dermatology? These individuals may be experts on modeling or singing, but they are not authorities on the products they are advertising. Yet many individuals readily accept what they say.

In conclusion, accepting the word of an authority figure may be a reliable and valid means of gaining knowledge, but only if the individual is truly an authority on the subject. Thus, we need to question "authoritative" sources of knowledge and develop an attitude of skepticism so that we do not blindly accept whatever is presented to us.

Tenacity

knowledge via tenacity
Knowledge gained from repeated ideas that are stubbornly clung to despite evidence to the contrary.

Gaining **knowledge via tenacity** involves hearing a piece of information so often that you begin to believe it is true, and then, despite evidence to the contrary, you cling stubbornly to the belief. This method is often used in political campaigns, where a particular slogan is repeated so often that we begin to believe it. Advertisers also use the method of tenacity by repeating their slogan for a certain product over and over until people begin to associate the slogan with the product and believe that the product meets its claims. For example, the makers of Visine advertised for over 40 years that "It gets the red out," and, although Visine eventually changed the slogan, most of us have heard the original so many times that we probably now believe it. The problem with gaining knowledge through tenacity is that we do not know whether the claims are true. As far as we know, the accuracy of such knowledge may not have been evaluated in any valid way.

Rationalism

knowledge via rationalism
Knowledge gained through logical reasoning.

Gaining **knowledge via rationalism** involves logical reasoning. With this approach, ideas are precisely stated and logical rules are applied to arrive at

a logically sound conclusion. Rational ideas are often presented in the form of a syllogism. For example:

All humans are mortal;
I am a human;
Therefore, I am mortal.

This conclusion is logically derived from the major and minor premises in the syllogism. Consider, however, the following syllogism:

Attractive people are good;
Nellie is attractive;
Therefore, Nellie is good.

This syllogism should identify for you the problem with gaining knowledge by logic. Although the syllogism is logically sound, the content of both premises is not necessarily true. If the content of the premises were true, then the conclusion would be true in addition to being logically sound. However, if the content of either of the premises is false (as is the premise "Attractive people are good"), then the conclusion is logically valid but empirically false and therefore of no use to a scientist. Logic deals with only the form of the syllogism and not its content. Obviously, researchers are interested in both form and content.

Empiricism

Knowledge via empiricism Knowledge gained through objective observations of organisms and events in the real world.

Knowledge via empiricism involves gaining knowledge through objective observation and the experiences of your senses. An individual who says "I believe nothing until I see it with my own eyes" is an empiricist. The empiricist gains knowledge by seeing, hearing, tasting, smelling, and touching. This method dates back to the age of Aristotle. Aristotle was an empiricist who made observations about the world in order to know it better. Plato, in contrast, preferred to theorize about the true nature of the world without gathering any data.

Empiricism alone is not enough, however. Empiricism represents a collection of facts. If, as scientists, we relied solely on empiricism, we would have nothing more than a long list of observations or facts. For these facts to be useful, we need to organize them, think about them, draw meaning from them, and use them to make predictions. In other words, we need to use rationalism together with empiricism to make sure that we are being logical about the observations that we make. As you will see, this is what science does.

knowledge via science Knowledge gained through a combination of empirical methods and logical reasoning.

Science

hypothesis A prediction regarding the outcome of a study involving the potential relationship between at least two variables.

Gaining **knowledge via science**, then, involves a merger of rationalism and empiricism. Scientists collect data (make empirical observations) and test hypotheses with these data (assess them using rationalism). A **hypothesis** is a prediction regarding the outcome of a study. This prediction concerns the