Ninth Edition

RESEARCH DESIGN *AND* METHODS

A Process Approach

KENNETH S. BORDENS | BRUCE B. ABBOTT

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A Process Approach

NINTH EDITION

Kenneth S. Bordens
Bruce B. Abbott
Indiana University—Purdue University Fort Wayne

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We dedicate this book to our parents, who provided us with the opportunity and inspiration to excel personally and professionally.

Lila Bordens and Walter Bordens
Irene Abbott and Raymond Abbott

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PREFACE

This, the ninth edition of *Research Design and Methods: A Process Approach*, retains the general theme that characterized prior editions. As before, we take students through the research process, from getting and developing a research idea, to designing and conducting a study, through analyzing and reporting data. Our goals continue to be to present students with information on the research process in a lively and engaging way and to highlight the numerous decisions they must make when designing and conducting research. We also continue to stress how their early decisions in the process affect how data are collected, analyzed, and interpreted later in the research process. Additionally, we have continued the emphasis on the importance of ethical conduct, both in the treatment of research subjects and in the conduct of research and reporting research results.

In this edition we have retained the organization of topics, retaining the basic process approach. We have updated material in a number of chapters and updated many of the examples of research presented throughout the book.

CHANGES IN THE NINTH EDITION

We have revised each chapter by updating examples and revising material where appropriate, as described below.

CHAPTER 1: EXPLAINING BEHAVIOR

A new introductory vignette focusing on the timely issue of texting while walking opens the chapter and is carried through the chapter where appropriate. We have rewritten the section on explaining behavior. We have expanded the section on thinking like a scientist to include a concrete example. In the section on science, nonscience, and pseudoscience, we have added a subsection on protoscience that explores science at the edges of current scientific understanding. Throughout the chapter, we have updated many research and real-world examples.

CHAPTER 2: DEVELOPING AND EVALUATING THEORIES OF BEHAVIOR

The definitions of "theory" and "hypothesis" have been changed to conform with those provided by the U.S. National Academy of Sciences and the accompanying text rewritten. The key term "scientific theory" has been changed to "theory."

CHAPTER 3: GETTING IDEAS FOR RESEARCH

This chapter remains largely unchanged from the previous edition. We have updated the sections on using computer searches to reflect changes in the user interface for popular search programs. Some dated illustrations have been deleted. Additional material on reviewer bias and author characteristics has been added to the section on peer review. Information on how journal editors serve as "gatekeepers" has been added to the section on values in research.

CHAPTER 4: CHOOSING A RESEARCH DESIGN

There are a few changes in Chapter 4 from the previous edition. The section on external validity has been expanded to include a contrast between field and laboratory and animal and human research. The section on simulation has been condensed and a new example of field research is provided (shopping while Black).

CHAPTER 5: MAKING SYSTEMATIC OBSERVATIONS

This chapter is unchanged from the eighth edition except for some updating and minor improvements in wording.

CHAPTER 6: CHOOSING AND USING RESEARCH SUBJECTS

Chapter 6 continues to focus on issues relating to using subjects/participants in the research process (e.g., sampling, volunteer bias, research deception, and using animals in research). We have updated the section on volunteer bias by condensing the section on participant characteristics. Much of the material from that section has been organized in a table. Similarly, the information on situational factors in volunteering has been organized into a table. The section on obtaining prior authorization to be deceived has been expanded to include research on the effects of prior authorization. The section on animal rights has been updated with material on some new issues in this realm. Similarly, the section on using deception in research has been updated to include new references on the problem of deception and how to reduce the impact of deception.

CHAPTER 7: UNDERSTANDING ETHICAL ISSUES IN THE RESEARCH PROCESS

The section on the Nurembeurg Code has been condensed. The section on ethical issues in Internet research has been updated to include a discussion of ethical issues concerning research using social media. Information on anonymity in Internet research has also been updated and expanded. The section on the IRB has been updated to include a discussion of ethics training courses. A new example of research fraud involving the social sciences (the case of Dutch social psychologist Diederik Stapel) replaces the old example.

CHAPTER 8: USING NONEXPERIMENTAL RESEARCH

A new subsection has been added to the section on ethnography discussing experimental ethnography. New examples of sociometry and archival research replace the examples in the eighth edition. Additionally, a new example on media bias replaces the existing example of content analysis. The section on content analysis has been expanded to include a section on information extraction and data mining.

CHAPTER 9: USING SURVEY RESEARCH

A new example opens the chapter. The new example focuses on a survey of how Americans use their cell phones to obtain political information before an election. The section on scale labeling has been expanded to include new research on this issue. Updated research is also included in the section on increasing response rates. New information has also been added on combating nonresponse bias in web research. A new section on mixed-mode surveys has been added to the section on administering questionnaires. New information on problems with random digit dialing and a discussion of address-based sampling have been added to the section on random sampling.

CHAPTER 10: USING BETWEEN-SUBJECTS AND WITHIN-SUBJECTS EXPERIMENTAL DESIGNS

Changes were made to the text, and some sections were shortened to improve readability.

CHAPTER 11: USING SPECIALIZED RESEARCH DESIGNS

Changes were made to several figures and to the text to improve clarity and readability.

CHAPTER 12: USING SINGLE-SUBJECT DESIGNS

The section on judging stable differences in performance across phases has been expanded to include supplements to visual analysis, including a software tool and measures of effect size. A new section describing the changing criterion design has been added, and "changing criterion design" has been added as a key term.

CHAPTER 13: DESCRIBING DATA

Examples of data summary sheets were condensed. The section on grouped versus individual data was shortened and moved under the section on entering your data. Some figures were revised to improve appearance and clarity.

CHAPTER 14: USING INFERENTIAL STATISTICS

A new section on significance testing and effect size was added. Discussion of the mechanics involved in looking up values in statistical stables was deleted. References were updated.

CHAPTER 15: USING MULTIVARIATE DESIGN AND ANALYSIS

Minor changes were made to improve organization and update references.

CHAPTER 16: REPORTING YOUR RESEARCH RESULTS

This chapter was significantly revised in the previous edition to reflect the changes in the sixth edition of the publication manual of the American Psychological Association. Information on electronic manuscript submission to journals has been added.

APPENDIX

Tables of random numbers and statistical tables were eliminated. These are widely available elsewhere and are becoming unnecessary due to the availability of computerized statistical packages that can compute exact *p* values.

ANCILLARIES

The ancillaries continue to be provided via the McGraw-Hill website at www.mhhe.com/bordens9e. Students will have access to online quizzes and information about APA writing style, literature searches, research participants, data analysis, plagiarism, and evaluating web sources. Instructors will have access to an instructor's manual, test bank, and PowerPoint presentations, all developed by the authors. These have all been updated to reflect the changes made to the text.

ACKNOWLEDGMENTS

After nine editions, the list is long of those to whom we owe our thanks—past reviewers, editors, colleagues, and students who have contributed their time and talents to improve the text and make it successful. For the ninth edition we especially wish to single out the reviewers: Nicole Dorey, University of Florida; Victor Duarte, North Idaho College; Frank M. Groom, Ball State University; Victoria Kazmerski, Penn State Erie; Roger Lew, University of Idaho; John Mullennix, University of Pittsburgh at Johnstown; Charisse Nixon, Penn State Erie; John S. Rosenkoetter, Missouri State University; and Mary Vandendorpe, Lewis University. Their criticisms and suggestions have been greatly appreciated. Our thanks go also to Penina Braffman, Managing Development Editor at McGraw, to Freelance Editor Erin Guendelsberger of ANSR Source; to our copy editor, Susan Nodine, who worked tirelessly to correct and improve our manuscript; to our indexer, Cynthia Rae Abbott, and to those other members of the McGraw-Hill staff who worked on the ancillaries and organized the text website where these resources are made available to students and instructors.

Finally, we offer a special thanks to our wives, Stephanie Abbott and Ricky Karen Bordens, for their support and encouragement, and to our families.

Kenneth S. Bordens
Bruce B. Abbott

CHAPTER 1

Explaining Behavior

CHAPTER OUTLINE

On September 21, 2008, after a day of playing basketball with his friends, 14-year-old Christopher Cepeda and four of his buddies began their journey home on foot. Along the way they came to a busy stretch of Highway 27, where a grassy median separated four lanes of traffic that sped by at 65 mph. The boys made it safely across the two northbound lanes and, upon seeing a tan, 1998 Buick sedan approaching in the southbound lane, they paused in the median. Christopher, distracted as he typed out a text message on his cell phone, never saw the car and stepped out into its path. The car struck the young teenager, throwing him into the windshield and then on to the pavement. In spite of the quick response from local emergency crews, later that day at an Orlando hospital, Christopher succumbed to his injuries.

A number of states have enacted laws banning the practice of texting while driving. Studies have demonstrated that texting while driving results in a degradation of driving skills (e.g., Drews, Pasupathi, & Strayer, 2008). Attention has now shifted to the problem of "distracted walking." This occurs when a person is so engrossed in doing something on a cell phone that the distracted person fails to identify potentially dangerous conditions. Sometimes the consequences of walking while being distracted by texting are harmless, even funny. For example, a video posted on YouTube shows a young woman walking in a mall who is so engrossed in her cell phone that she doesn't notice a fountain and falls right into it. We can all laugh at the poor woman's fate, knowing that she was not seriously hurt. However, as in the case of Christopher Cepeda, distracted walking can have tragic consequences.

We could engage in endless speculation about whether such accidents were caused as a direct result of texting while driving or walking. Some may argue that Christopher's age played a role in the accident; others may blame the driver's response. Some may speculate whether drugs or alcohol had been a factor. Although such speculations make for interesting conversation, they do nothing to establish whether being distracted while driving or walking affects a person's ability to notice and respond to potentially dangerous situations. For that you need good, solid research.

Questions such as the one about one's ability to multitask (e.g., talk on the phone while walking) almost cry out for answers. This is where science and scientists come in. When confronted with situations such as Christopher Cepeda's, scientists are curious. Like most of us, they wonder if there is a relationship between the distraction of talking or texting on a cell phone and walking ability. Scientists, however, go beyond mere speculation: they formulate ways to determine clearly the relationship between talking on a cell phone and walking ability and then design research studies to test the relationship.

This book is about how the initial curiosity sparked by an event such as the Cepeda accident gets transformed into a testable research question and eventually into a research study yielding data that are analyzed. Only through this process can we move beyond dinner table speculations and into the realm of scientific explanation.

WHAT IS SCIENCE, AND WHAT DO SCIENTISTS DO?

The terms *science* and *scientist* probably conjure up a variety of images in your mind. A common image is that of a person in a white lab coat surrounded by bubbling flasks and test tubes, working diligently to discover a cure for some dreaded disease. Alternatively, our lab-coated scientist might be involved in some evil endeavor that will threaten humankind. Books, movies, and television have provided such images. Just think about the classic horror films of the 1940s and 1950s (e.g., *Frankenstein*), and it is not hard to see where some of these images come from.

Although these images may be entertaining, they do not accurately capture what science actually is and what real scientists do. Simply put, **science** is a set of methods used to collect information about phenomena in a particular area of interest and build a reliable base of knowledge about them. This knowledge is acquired via *research,* which involves a scientist identifying a phenomenon to study, developing hypotheses, conducting a study to collect data, analyzing the data, and disseminating the results. Science also involves developing theories to help better describe, explain, and organize scientific information that is collected. At the heart of any science (psychology included) is information that is obtained through observation and measurement of phenomena. So, for example, if I want to know if text messaging while walking is a serious threat to safety, I must go out and make relevant observations. Science also requires that any explanations for phenomena can be modified and corrected if new information becomes available. Nothing in science is taken as an absolute truth. All scientific observations, conclusions, and theories are always open to modification and perhaps even abandonment as new evidence arises.

Of course, a **scientist** is someone who does science. A scientist is a person who adopts the methods of science in his or her quest for knowledge. However, this simple definition does not capture what scientists do. Despite the stereotyped image of the scientist hunkered over bubbling flasks, scientists engage in a wide range of activities designed to acquire knowledge in their fields. These activities take place in a variety of settings and for a variety of reasons. For example, you have scientists who work for pharmaceutical companies trying to discover new medications for the diseases that afflict humans. You have scientists who brave the bitter cold of the Arctic to take ice samples that they can use to track the course of global climate change. You have scientists who sit in observatories with their telescopes pointed to the heavens, searching for and classifying celestial bodies. You have scientists who work at universities and do science to acquire knowledge in their chosen fields (e.g., psychology, biology, or physics). In short, science is a diverse activity involving a diverse group of people doing a wide range of things. Despite these differences, all scientists have a common goal: to acquire knowledge through the application of scientific methods and techniques.

Science as a Way of Thinking

It is important for you to understand that science is not just a means of acquiring knowledge; it is also a way of thinking and of viewing the world. A scientist approaches a problem by carefully defining its parameters, seeking out relevant information, and subjecting proposed solutions to rigorous testing. The scientific view of the world leads a person to be skeptical about what he or she reads or hears in the popular media. Having a scientific outlook leads a person to question the validity of provocative statements made in the media and to find out what scientific studies say about those statements. In short, an individual with a scientific outlook does not accept everything at face value.

Let's see how thinking like a scientist might be applied. Imagine that you are having difficulty relaxing while taking important exams, resulting in poor performance. One night while watching television you see an advertisement for something that might help you relax. According to the advertisement, a new extract of lavender has been discovered that, when inhaled, will help you relax. There are several testimonials from users of the product to back up the claims made in the ad. Better yet, it only costs $19.95 plus shipping and handling! And, they will double your order if you order right away! The question is whether or not you are going to shell out the money for the lavender scent.

A person who is *not* thinking like a scientist will pull out her credit card and place the order. A person who *is* thinking like a scientist will question the validity of the claims made in the ad and make an effort to find out whether the lavender scent will in fact reduce stress and improve performance. This involves taking the time and making the effort to track down relevant research on the effectiveness of aromatherapy, specifically the effects of lavender scent on stress. Imagine you do a quick literature search and find an article by Howard and Hughes (2008) that tested the effect of a lavender scent against a placebo scent (a scent without any purported therapeutic value) and against no scent on stress responses. Howard and Hughes, you discover, found that scents had no effect on stress unless participants were specifically led to expect the scents to have an effect. In short, the effect of the lavender scent could be explained by expectation effects. So, you decide to save your money.

This is but one example of how thinking like a scientist leads one to question a claim and look for empirical evidence to verify that claim. There are many other situations where thinking like a scientist can better allow you to evaluate the validity of a claim or a conclusion. For example, during an election year we are bombarded with poll after poll about candidates and who is in the lead. Rather than accepting on face value that candidate X has a lead over candidate Y, you should obtain a copy of the actual survey results (often available online at the pollster's website), and then look at the sample employed and how the questions were worded. As we will see in later chapters, biased samples and question wording can affect the validity of survey findings.

How Do Scientists Do Science?

In their quest for knowledge about a phenomenon, scientists can use a wide variety of techniques, each suited to a particular purpose. Take the question about using a cell phone while walking. You, as a scientist, could approach this issue in several ways. For example, you could examine health records on injuries incurred while talking on a cell phone during walking. You would then examine your data to see if there is a relationship between using a cell phone and being injured while walking. If you found that there was a greater frequency of accidents when using a cell phone, this would verify the role of cell phones in pedestrian accident injuries.

Another way you could approach this problem is to conduct a controlled experiment. You could have participants navigate through a controlled environment while either using or not using a cell phone. If you find that participants bump into more objects when using a cell phone, you would have verified the effects of distracted walking on accidents.

QUESTIONS TO PONDER

1. What is science, and what do scientists do?
2. What is meant by the statement that science is a way of thinking? (Explain.)
3. How do scientists obtain knowledge on issues that interest them?

Basic and Applied Research

Scientists work in a variety of areas to identify phenomena and develop valid explanations for them. The goals established by scientists working within a given field of research may vary according to the nature of the research problem being considered. For example, the goal of some scientists is to discover general laws that explain particular classes of behaviors. In the course of developing those laws, psychologists study behavior in specific situations and attempt to isolate the variables affecting behavior. Other scientists within the field are more interested in tackling practical problems than in finding general laws. For example, they might be interested in determining which of several therapy techniques is best for treating severe phobias.

An important distinction has been made between basic research and applied research along the lines just presented.

Basic Research **Basic research** is conducted to investigate issues relevant to the confirmation or disconfirmation of theoretical or empirical positions. The major goal of basic research is to acquire general information about a phenomenon, with little emphasis placed on applications to real-world examples of the phenomenon (Yaremko, Harari, Harrison, & Lynn, 1982). For example, research on the memory process may be conducted to test the efficacy of interference as a viable theory of forgetting. The researcher would be interested in discovering something about the forgetting process while testing the validity of a theoretical position. Applying the results to forgetting in a real-world situation would be of less immediate interest.

Applied Research The focus of **applied research** is somewhat different from that of basic research. Although you may still work from a theory when formulating your hypotheses, your primary goal is to generate information that can be applied directly to a real-world problem. A study by Jodi Quas and her colleagues (2007) provides a nice example of an applied study. In a number of criminal and civil trials, children may be called to testify about something (such as abuse) that may have happened to them. One concern is that children's memories may not be as accurate as adult memories or that it may be easier to implant memories into children than adults. Quas et al. investigated a number of factors that can affect the accuracy of children's memory. They found that children who were interviewed multiple times about an event that never occurred showed greater memory accuracy and less susceptibility to suggestion than children interviewed once, even if the interviewer was biased. Results such as these can help law enforcement officers design interviews for children that will maximize memory accuracy. Further examples of applied research can be found in the areas of clinical, environmental, and industrial psychology (among others).

Overlap Between Basic and Applied Research The distinction between applied and basic research is not always clear. Some research areas have both basic and applied aspects. The Quas et al. study provides a good example of research that has both applied and basic implications. Their results can inform law enforcement personnel and others who may have to interview young children how to best approach the interview process. In addition to these applied implications, this research has basic implications as well because the results tell us something about developmental changes in how memory works and the factors that affect memory accuracy.

Even applied research is not independent of theories and other research in psychology. The defining quality of applied research is that the researcher attempts to conduct a study the results of which can be applied directly to a real-world event. To accomplish this task, you must choose a research strategy that maximizes the applicability of findings.

Framing a Problem in Scientific Terms

Kelly (1963) characterized each person as a scientist who develops a set of strategies for determining the causes of behavior observed. We humans are curious about our world and like to have explanations for the things that happen to us and others. After reading about Christopher Cepeda's accident, you may have thought about potential explanations for the accident. For example, you might have questioned whether using a cell phone while walking is uniquely distracting compared with other distractions (e.g., talking with friends).

Usually, the explanations we come up with are based on little information and mainly reflect personal opinions and biases. The everyday strategies we use to explain what we observe frequently lack the rigor to qualify as truly scientific approaches. In most cases, the explanations for everyday events are made on the spot, with little attention given to ensuring their accuracy. We simply develop an explanation and, satisfied with its plausibility, adopt it as true. We do not consider exploring whether our explanation is correct or whether there might be other, better explanations.

If we do give more thought to our explanations, we often base our thinking on hearsay, conjecture, anecdotal evidence, or unverified sources of information. These revised explanations, even though they reduce transient curiosity, remain untested and are thus of questionable validity. In the Christopher Cepeda case, you might come to the conclusion that texting while walking distracts a person from important environmental cues that signal danger. Although this explanation seems plausible, without careful testing it remains mere speculation. To make matters worse, we have a tendency to look for information that will confirm our prior beliefs and assumptions and to ignore or downplay information that does not conform to those beliefs and assumptions. So, if you believe that talking on cell phones causes pedestrian accidents, you might seek out newspaper articles that report on such accidents and fail to investigate the extent to which cell phone use while walking does not lead to an accident. At the same time, you may ignore information that conflicts with your beliefs. The human tendency to seek out information that confirms what is already believed is known as **confirmation bias**.

Unfounded but commonly accepted explanations for behavior can have widespread consequences when the explanations become the basis for social policy. For example, segregation of Blacks in the South was based on stereotypes of assumed racial differences in intelligence and moral judgment. These beliefs sound ludicrous today and have failed to survive a scientific analysis. Such mistakes might have been avoided if lawmakers of the time had relied on objective information rather than on prejudice.

To avoid the trap of easy, untested explanations for behavior, we need to abandon the informal, unsystematic approach to explanation and adopt an approach that has proven its ability to find explanations of great power and generality. This approach, called the *scientific method,* and how you can apply it to answer questions about behavior are the central topics of this book.

LEARNING ABOUT RESEARCH: WHY SHOULD YOU CARE?

Students sometimes express the sentiment that learning about research is a waste of time because they do not plan on a career in science. Although it is true that a strong background in science is essential if you plan to further your career in psychology after you graduate, it is also true that knowing about science is important even if you do *not* plan to become a researcher.

The layperson is bombarded by science every day. When you read about the controversy over stem-cell research or global warming, you are being exposed to science. When you read about a "scientific" poll on a political issue, you are being exposed to science. When you hear about a new cure for a disease, you are being exposed to science. When you are persuaded to buy one product over another, you are being exposed to science. Science, on one level or another, permeates our everyday lives. To deal rationally with your world, you must be able to analyze critically the information thrown at you and separate scientifically verified facts from unverified conjecture.

Often, popular media such as television news programs present segments that *appear* scientific but on further scrutiny turn out to be flawed. One example was a segment on the ABC television news show *20/20* on sexual functions in women after a hysterectomy. In the segment, three women discussed their posthysterectomy sexual dysfunction. One woman reported, "It got to the point where I couldn't have sex. I mean, it was so painful . . . we couldn't do it." The testimonials of the three patients were backed up by a number of medical experts who discussed the link between hysterectomy and sexual dysfunction.

Had you watched this segment and looked no further, you would have come away with the impression that posthysterectomy sexual dysfunction is common. After all, all the women interviewed experienced it, and the experts supported them. However, your impression would not be correct. When we examine the research on posthysterectomy sexual functioning, the picture is not nearly as clear as the one portrayed in the *20/20* segment. In fact, there are studies showing that after hysterectomy, women may report an *improvement* in sexual function (Rhodes, Kjerulff, Langenberg, & Guzinski, 1999). Other studies show that the type of hysterectomy a woman has undergone makes a difference. If the surgery involves removing the cervix (a total hysterectomy), there is more sexual dysfunction after surgery than if the cervix is left intact (Saini, Kuczynski, Gretz, & Sills, 2002). Finally, the Boston University School of Medicine's Institute for Sexual Medicine reports that of 1,200 women seen at its Center for Sexual Medicine, very few of them complained of posthysterectomy sexual dysfunction (Goldstein, 2003).

As this examples suggests, whether you plan a career in research or not, it is to your benefit to learn how research is done. This will put you in a position to evaluate information that you encounter that is supposedly based on "science."

EXPLORING THE CAUSES OF BEHAVIOR

Psychology is the science of behavior and mental processes. The major goals of psychology (as in any other science) are (1) to build an organized body of knowledge about its subject matter and (2) to describe mental and behavioral processes and develop reliable explanations for these processes. For example, psychologists interested in aggression and the media would build a storehouse of knowledge concerning how various types of media violence (e.g., movies, television shows, cartoons, or violent video games) affect aggressive behavior. If it were shown that violent video games do increase aggression, the psychologist would seek to explain how this occurs.

How do you, as a scientist, go about adding to this storehouse of knowledge? The principal method for acquiring knowledge and uncovering causes of behavior is