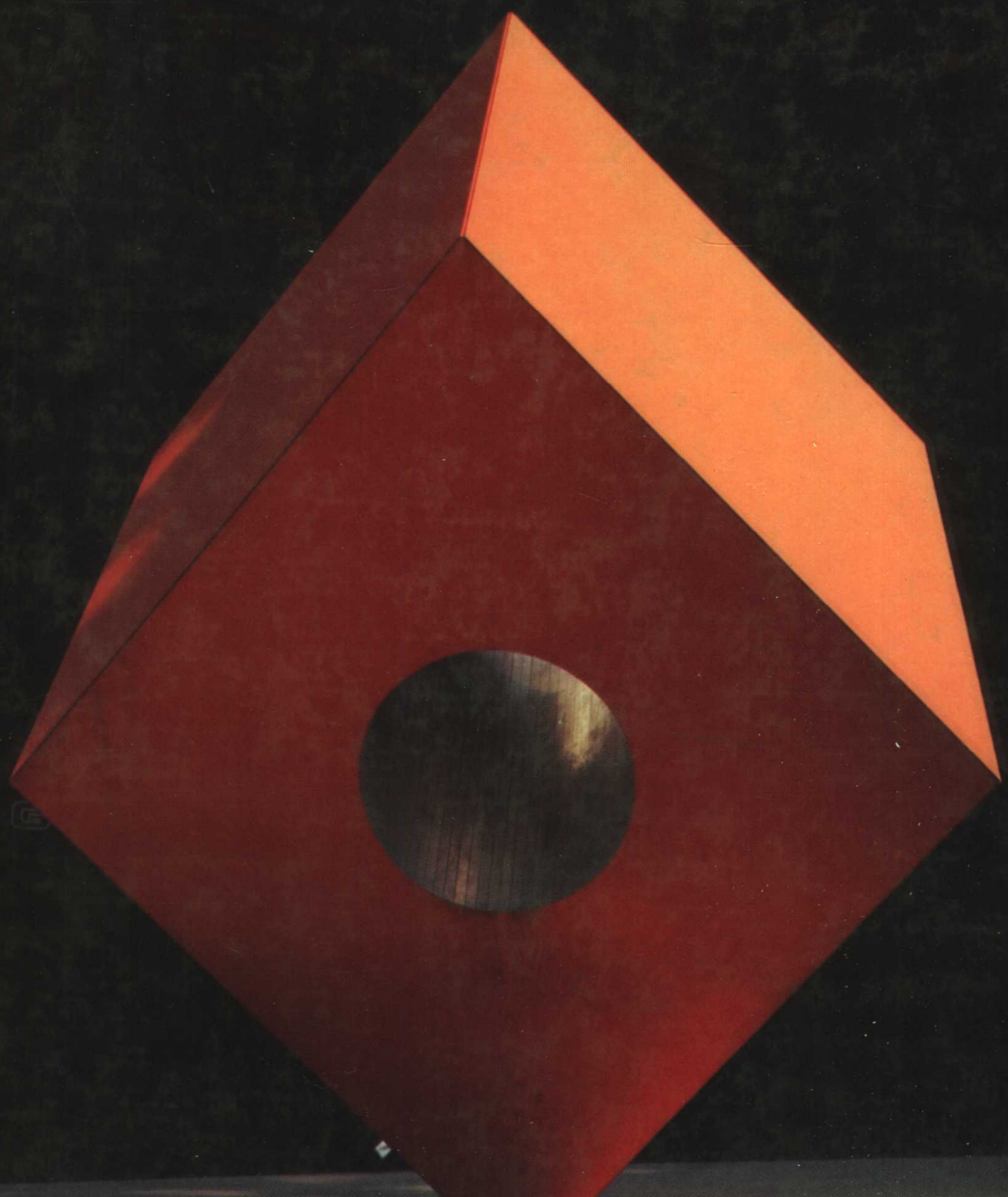
Research Design and Methods

A PROCESS APPROACH

Kenneth S. Bordens / Bruce B. Abbott



Research Design and Methods: A Process Approach

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Preface

The research methods course that most psychology majors are required to take is a challenge for both students and the instructor. The challenge for students is to deal with concepts that are alien and try to understand a new way of looking at the world. The challenge for the instructor is to ensure not only that students understand the concepts important to research, but also that they can apply them to the conduct and evaluation of research. Unfortunately, many research methods texts do precious little to teach students how research is actually done. Although students may come away with a knowledge about different research designs and methods, they may not fully understand the nuances involved in developing a successful research study.

The goal of our text, *Research Design and Methods: A Process Approach,* is to provide a step-by-step guide to designing, conducting, reporting, and evaluating psychological research. At each step, students are given the information they need to evaluate the options at their disposal and carry out the step. The text takes students from the elementary concepts of scientific research to some fairly advanced topics while maintaining a relaxed and readable style.

We have made the text complete enough to serve the needs of different instructors, course formats, and levels. Many of the chapters can be assigned or omitted as desired without affecting the continuity of the text. Instructors wishing to focus on experimental methods, for example, could omit Chapters 6 and 7. Chapters 11 and 12 provide a review of descriptive and inferential statistics that could be omitted if students already have a strong background in these areas. (We find, however, that our own students benefit from the review.) For courses where more advanced material is suitable, the instructor could include the chapters in Part IV. Part IV provides chapters on multivariate design and analysis (a brief survey of the techniques available and their uses), theory construction and use, and topics related to biases affecting the published research literature.

We have included expanded discussions of topics given cursory treatment in many research methods texts. For example, Chapters 6 and 7 include

material on nonexperimental designs, quasi-experimental designs, and questionnaire construction and administration; whereas Chapter 13 shows how to use computers to analyze data, with illustrations for *SPSS-X*,*SAS*, *BMD-P*, and a commercial package for use on personal computers.

Even in the more "traditional chapters" we have included expanded discussions of topics, supported with interesting examples. In Chapter 2, for example, we give detailed instructions for using the *Psychological Abstracts* and *Social Science Citations Index*, and briefly describe how to use *Index Medicus* and on-line computer searches. Our coverage of ethical issues in Chapter 5 traces the origins of the APA ethical principles to the Nazi war crimes trials at Nuremberg after the close of World War II, and in Chapter 10 we detail the origins and history of the single-subject design in psychology. In Chapter 14 we go beyond simply describing APA writing style and providing a sample paper. We have also explored the structure of an APA-style manuscript and given some tips on how to write clearly.

Several features of the text help students organize and understand the material presented. Each chapter ends with a list of key terms. Within each chapter, each key term is identified in boldface type and defined. We have made liberal use of examples from the research literature to illustrate many of the concepts and techniques discussed. We have also included numerous figures and tables to help students understand textual material.

In addition to the learning aids included in the text, we have developed an extensive ancillary package. A student workbook includes review questions for each chapter along with "hands-on" exercises for students to do. We have also provided a set of classroom-tested research projects that students can conduct to gain experience with various research designs. In addition, we have developed an easy-to-use statistical package for the personal computer that students can use to analyze their data.

A project such as this requires the help of many people. We thank all those who contributed their time and talent, although we can name here only a few. Our reviewers offered many helpful suggestions for improving the manuscript. If the book still has flaws it is because we failed to implement them all. Our appreciation for this advice goes to Helen J. Crawford, University of Wyoming; Arthur D. Fisk, University of South Carolina; Daniel Leger, University of Nebraska; Beth A. Shapiro, Emory University; Robert F. Smith, George Mason University; Michael S. Wogalter, University of Richmond; and Barbara Tabachnick of California State University, Northridge for her excellent review of Chapter 15. We would also like to thank our colleague Elaine Blakemore for her input into Chapter 6; and Irwin Horowitz for his advice and support. Our thanks go also to Franklin C. Graham, Sponsoring Editor at Mayfield Publishing, for providing encouragement and prodding, both of which were necessary; and to all the others at Mayfield Publishing and Business Media Resources who contributed to this text.

Our thanks go to our wives, Ricky Karen Bordens and Stephanie Abbott, and our families for their support and encouragement. They put up with seeing very little of us but the backs of our heads this past year as we hunched over our keyboards and stared at our computer screens while waiting for the muses to speak.

KENNETH S. BORDENS
BRUCE B. ABBOTT

Contents

PART I

GENERAL PRINCIPLES OF RESEARCH DESIGN

C H A P T E R 1

Studying Behavior

If you are like most people, you often find yourself wondering about the causes of behavior you see occurring around you. You may ask, "Why is that student arguing with her professor?" or "Why did those terrorists blow up that plane?" or "Why did the cat disappear for two weeks last spring?" As we attempt to formulate explanations based on the information at our disposal, we behave much as scientists do. As a matter of fact, Kelly (1963) characterized each person as a scientist who has developed a set of strategies for determining the causes of observed behavior.

Although Kelly characterized people as scientists, these everyday strategies frequently lack the rigor to qualify as truly scientific. In most cases the explanations developed for behaviors observed in everyday life are made on the spot with little thought to accuracy. We commonly develop an explanation and then, satisfied that the explanation makes sense, simply adopt it with no further thought. Or, if we do give more thought to our explanations, we often base our thinking on hearsay, conjecture, anecdotal evidence, or unverified sources of information. Although our everyday explanations may serve to reduce transient curiosity about a behavior, they remain untested conjectures.

Accepted as fact, such conjectures may become the bases for future actions. For example, you may conclude that a person angrily stomping out of a room has a nasty personality, although in reality this is not the case. This negative impression may lead you to refuse a social invitation from that person. Perhaps you find out that the two of you had much in common and could have become good friends. In a real sense, you have been victimized by a faulty explanation.

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. These mistakes may have been avoided if lawmakers of the time had relied on objective information rather than prejudice.

To avoid the trap of easy, untested explanations for behavior, we need to abandon the informal, unsystematic approach to explanation and to 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.

This book is about the research process. In a broader sense it is about the business of finding unambiguous explanations for behavior. This text describes how to develop scientifically testable research questions about behavior, how to develop and use acceptable methods of observation by using appropriate research designs, how to properly analyze and interpret the resulting data, and how to use these results to arrive at scientifically acceptable explanations.

Whether or not you intend to pursue a career in psychological research, these concepts will be among the more important and useful information that you take with you when you leave college. The complex world of today constantly demands that you evaluate information and draw valid conclusions from it. If you know how to proceed on a scientific basis, you will be in a much better position to deal with such information and to evaluate the conclusions and explanations of others.

Explaining Behavior

Psychology is the science of behavior. The goal of any science is to provide valid and reliable explanations for observed behavior and to build a body of knowledge about that behavior. In order to accomplish this, the scientist attempts to uncover **scientific explanations** for behavior. The next sections contrast scientific explanations with common-sense explanations, and with explanations based on belief and faith.

Common-sense Versus Scientific Explanations

In our everyday lives we develop rather simplistic explanations for observed behaviors. These explanations are based largely on the limited information available from the observed situation. We then develop an explanation for that behavior based on what we assume to be true. For example, after reading about a woman who was raped while thirty five witnesses watched, you might conclude that "urban apathy" was the cause. These explanations we develop on a day-to-day basis are **common-sense explanations.**

Three important differences exist between common-sense explanations and scientific explanations. First, common-sense explanations usually are developed based on casual observations of behavior, conjecture, hearsay, anecdotal evidence, or a combination of all of these. In contrast, scientific explanations are based on carefully made observations of behavior. Scientists determine in advance of the observation what aspects of behavior will be observed, under what conditions, and how these aspects will be measured.

The second difference is that scientific explanations are subjected to testing against plausible alternatives. The angry person observed stomping out of the

room may have been provoked by an unkind remark or an unfair grade. This explanation could provide a reasonable alternative to the notion that the individual has a hot-tempered personality. Further observations of the person under different situations could decide the issue. To the extent that these tests support an explanation and rule out alternatives, we can have more confidence that the explanation is valid.

The third difference between common-sense and scientific explanations is that scientific explanations are tested for their abilities to explain behavior adequately across a variety of apparently dissimilar situations. Those explanations that deal with the greatest variety of situations are preferred over those with a more restricted scope. Common-sense explanations usually concern only explanations of the original observations. Thus, scientific explanations tend to provide a deeper insight into the underlying causes of behavior and to apply more generally than common-sense explanations. To see how common-sense explanations may fail to provide a truly general account of behavior, consider the following event.

Late in December 1903, a fire started in the crowded Iroquois Theater of Chicago and 602 people lost their lives. Of interest to psychologists is not the fact that 602 people died, *per se*, but rather the circumstances that led to many of the deaths. Many of the victims were not directly killed by the fire. Rather they were trampled to death in the panic that ensued in the first few minutes after the fire started. In his classic book *Social Psychology*, Brown (1965) reproduced an account of the event provided by Eddie Foy, a famous comedian of the time. According to Foy's account,

> . . . it was inside the house that the greatest loss of life occurred, especially on the stairways leading down from the second balcony. Here most of the dead were trampled or smothered . . . . In places on the stairways, particularly where a turn caused a jam, bodies were piled seven or eight deep. (Brown, 1965, p. 715).

As a student of psychology you may already be formulating ideas to explain why normally rational human beings would behave as a mindless crowd in this situation. Clearly, many lives would have been saved had the patrons of the Iroquois Theater filed out in a more orderly fashion. How would you explain the tragedy?

A logical and seemingly obvious answer is that the patrons believed their lives to be in danger and wanted to leave the theater as quickly as possible. Hence, you may want to explain the panic inside the theater as motivated by a desire to survive.

Notice that the explanation at this point is probably adequate to explain the crowd behavior under the specific conditions inside the theater, and perhaps to explain the same behavior under other life-threatening conditions. However, the explanation is probably too situation specific to serve as a general scientific explanation of irrational crowd behavior. It cannot explain, for example, the following incident.

On December 10, 1979, a crowd of young people lined up outside a Cincinnati arena to wait for the doors to open for a concert by the popular rock group "The Who." As the time neared for the doors to open, the crowd began to surge ahead. Eleven people were trampled to death even though the conditions were

certainly less than life threatening. In fact, the identifiable reward in this situation was obtaining the best seat possible at an open-seating concert.

Clearly, the explanation for irrational crowd behavior at the Chicago theater cannot be applied to the Cincinnati tragedy. People were not going to die if they failed to get desirable seats at the concert. What seemed like a reasonable explanation for irrational crowd behavior in the Iroquois Theater case must be discarded here.

You must look for common elements to explain such similar, yet diverse, events. In both situations the available reinforcers were perceived to be limited. A powerful reinforcer (avoiding pain and death) in the Iroquois Theater undoubtedly was perceived as attainable only for a brief time. Similarly, the perceived reinforcer (a seat close to the stage) in Cincinnati, although not essential for survival, was also available for a limited time only. In both cases, apparently irrational behavior resulted as large numbers of people individually attempted to maximize the probability of obtaining the reinforcer.

The new tentative explanation for the irrational behavior now centers around the perceived availability of reinforcers, rather than situation-specific variables. As described later in this chapter, this new tentative explanation has been tested in research and has received some support.

As these examples illustrate, simple common-sense explanations may not apply beyond the specific situations that spawned them. The scientist interested in "irrational crowd behavior" would look for a more general concept (such as perceived availability of reinforcers) to explain observed behavior. This is not to say that simple, obvious explanations are always incorrect. When you are looking for an explanation that transcends situation-specific variables you must often look beyond simple, common-sense explanations.

Belief Versus Scientific Explanations

Explanations for behavior often arise not from common-sense or scientific observation, but from individuals or groups who (through indoctrination, upbringing, or personal need) have accepted on faith the truth of their beliefs. You may agree or disagree, but you should be aware that explanations offered by science and explanations by belief are fundamentally different.

Explanations based on belief are accepted because they come from a trusted source or appear to be consistent with the larger framework of belief. No evidence is required. If evidence suggests that the explanation is incorrect, then the evidence is discarded or reinterpreted to make it appear consistent with the belief. For example, certain religions believe the Earth was created only a few thousand years ago. The discovery of fossilized remains of dinosaurs and other creatures (apparently millions of years old) challenged this belief. To explain the existence of these remains, those defending the belief suggest that the fossils are actually natural rock formations that resemble bones, or that the fossils are the remains of the victims of Noah's flood. Thus, rather than calling the belief into question, apparently contrary evidence is interpreted to appear consistent with the belief.

Whereas explanations based on belief are assumed to be true, scientific explanations are only provisionally accepted. Scientific explanations are accepted because they are consistent with objective evidence and have survived

rigorous testing against plausible alternatives. Scientists accept the possibility that better explanations may turn up or that new tests may show the current explanation is inadequate.

Scientific explanations also differ from faith-based explanations in the subject areas for which explanations are offered. Whereas explanations based on belief may seek to answer virtually any question, scientific explanations are limited to addressing those questions that can be answered by means of objective observations. For example, what happens to a person after death or why suffering exists in the world are explained by religion, but such questions remain outside the realm of scientific explanation. No objective tests or observations can be performed to answer these questions within the confines of the scientific method. Science offers no explanation on questions such as these and you must rely on faith or belief for answers. However, where questions can be settled on the basis of objective observation, scientific explanations generally have provided more satisfactory and useful accounts of behavior than those provided by *a priori* belief.

When Scientific Explanations Fail

Scientific explanation is preferable to other kinds of explanation when scientific methods can be applied. Using a scientific approach maximizes the chances of discovering the best explanation for an observed behavioral phenomenon. Despite the application of the most rigorous of scientific methods, instances do occur when the explanation offered by a scientist is not valid. Scientific explanations are sometimes flawed. Understanding some of the pitfalls inherent to developing scientific explanations will help you avoid arriving at flawed or incorrect explanations for behavior.

Failures Caused by Faulty Inference

Explanations may fail because developing them involves an inference process. We make observations and then infer the causes for the observed behavior. This inference process always involves the danger of incorrectly inferring the underlying mechanisms that control behavior.

The problem of faulty inference is illustrated in a satirical book by Macaulay (1979) called *Motel of the Mysteries*. In this book a scientist (Howard Carson) uncovers the remnants of our civilization 5000 years from now. Carson unearths a motel and begins the task of explaining what our civilization was like, based on the artifacts found in the motel.

Figure 1-1 presents an illustration from Macaulay's book showing three "musical instruments" unearthed at the site. The archeologist describes these instruments as follows:

> The two trumpets on the [bottom] were found attached to the wall of the inner chamber at the end of the sarcophagus. They were both coated with a silver substance similar to that used on the ornamental pieces of the metal animals. Music was played by forcing water from the sacred spring through the trumpets under great pressure. Pitch was controlled by a large silver handle