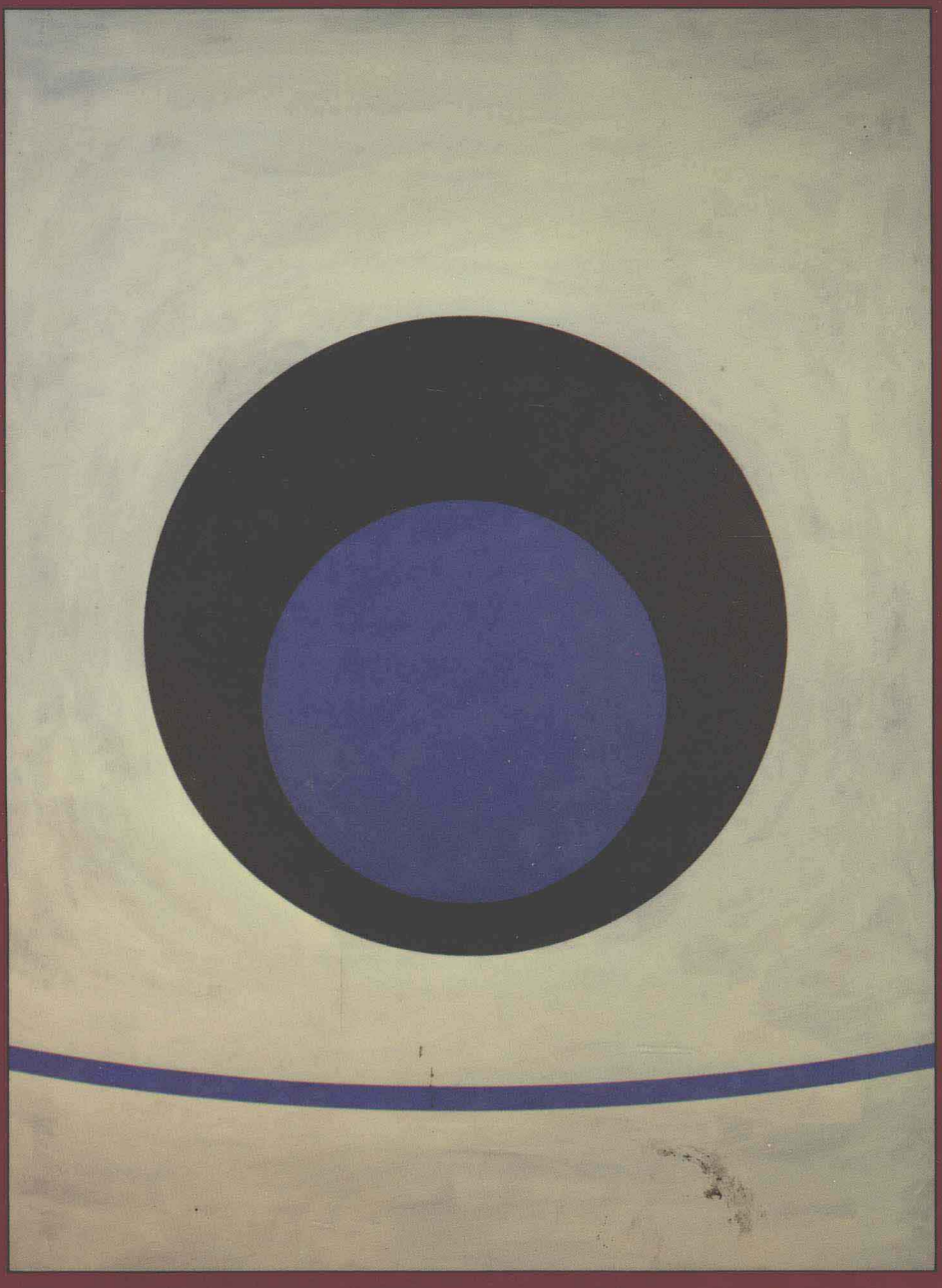
METHODS



WILLIAM RAY AND RICHARD RAVIZZA

SECOND EDITION

Methods Toward a Science of Behavior and Experience

Second Edition

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To Adam & Lauren & Susan (wjr)

a child is the most superb research scientist we can get
Buckminster Fuller

To Diane (rr)

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PREFACE

We live in a time when books on science are setting sales records. Yet, at many universities, the experimental course remains the one that students dread and put off until the last minute. This seems strange to us, since many of our colleagues are excited about what they do in psychology and approach research with a real desire to know. This makes us think that, in the process of teaching experimental psychology, we have often neglected to include our own experience in psychology, especially our reasons for attempting a science of behavior and experience in the first place. Thus, one of our major goals in writing this book is to introduce the student both to the basics of doing science and to the spirit that motivates many scientists.

One idea we try to convey to the student from the very beginning is the relationship of science and philosophy. We do this not only through the introduction of propositional logic in Chapter 2, but through a discussion of individuals who have shaped our ideas about science. For example, in the first two chapters, the student is introduced not only to Newton's rules of reasoning, but to the views of Karl Popper and Thomas Kuhn on how science works. We also show the student how some approaches to science, such as the use of strong inference and the development of a research program, have allowed certain fields to move at an accelerated rate. Likewise, we show the student that science cannot be done without reference to values. We do this not only in our discussion of the ecology of the experimental situation in Chapter 10 and our discussion of ethics in Chapter 13, but throughout the text.

However useful, abstractions alone do not teach the student about science as it is practiced, much less how to practice science themselves. Thus, we also emphasize the concrete. In our discussion of descriptive statistics in Chapter 3, we teach students how to read graphs and how to plot them. In

Chapter 5, we include detailed information on how to use major library reference works, such as *Psychological Abstracts, Index Medicus,* and *Science* and *Social Citation Indexes.* In Chapter 14, we not only teach the student how to write up an experiment, but also include a valuable checklist that can be used both for writing up an article and for presenting a research proposal. Because of our desire to make science concrete for the student, we have included interviews with active psychologists on how they first obtained the ideas for their studies. These interviews are followed by a discussion of how to turn an idea into a testable hypothesis.

Although most students grasp the idea of asking testable questions, they often have an uncertainty of what exactly it is that they are testing in research. To help clarify this point, we have presented the process of hypothesis testing both conceptually and practically. In Chapter 4, we presented a conceptual understanding of inferential statistics, using a popular video game to illustrate probability. We likewise stress the process of making decisions and the importance of logically ruling out alternative hypotheses. Although this process begins in the first chapter and continues throughout the book, Chapter 2 emphasizes the use of logic and drawing conclusions.

In order to help faculty teach this course and students understand the material better, we have made a special effort to define and illustrate what we know to be general problem areas for students. We have also included material at the end of each chapter that not only summarizes the main points in the chapter but also includes questions to test comprehension, and discussion questions and projects for better integration of the material. Included in this section are designs for the students to criticize and conclusions to evaluate. Our talks with faculty across the country have led us to pay special attention to certain topics. For example, the concept of interaction effect is not only illustrated with research examples, but numerous possible outcomes are graphically represented for the student to see. We have also carefully walked the student through the interpretation of interaction effects and explained why an interaction effect must be interpreted before a main effect. These discussions have been facilitated by our explanation of the concept behind the *F*-ratio. Beginning in Chapter 6 and continuing throughout the rest of the text, the logic of the *F*-ratio is used in our discussions of experimental control and variation. By emphasizing the factors that influence either the numerator or the denominator of the *F*-ratio, students are able conceptually to grasp what factors will influence their acceptance or rejection of the null hypothesis. We gave special attention to two other problem areas for students: the meaning of *causation* in science, and the use of the terms *error* and *chance* in relation to experimentation.

By using the title *Methods Toward a Science of Behavior and Experience,* we wanted to convey a sense not only of where experimental psychology has been but of where it might be going. For example, more and more experimental courses in this country are including information on interviews, questionnaires, and survey research. We have included this material in Chapter 12. Even the guidelines for writing up research required by the American Psychological Association change from time to time, and 1984 was such a time. Chapter 14 and Appendixes B and C reflect the new APA publication manual. Likewise, Chapter 13 includes the most recent revision of the APA ethical principles.

Not only does research change in particulars such as formats for publication but the field also matures in terms of broader conceptual approaches and its willingness to consider new topics. We expand on this idea in the final chapter of the book, in which we discuss the potential for a scientific psychology. We point out that psychology was once almost a battleground for those who were interested in behavior and those interested in experience. But today, with scientific studies of attention, awareness, consciousness, and communication between species, we see a new group of scientists who are interested in both behavior *and* experience, not only in others but in themselves.

This book grew out of discussions concerning our experience of science and the role it currently plays in psychology. At this time we would like to acknowledge individuals who joined us in these discussions at various times. We especially appreciate the time Dale Harris spent discussing with us his perspective on the history of the experimental movement in psychology. We also appreciate the willingness of Lance Shotland, Nora Newcombe, and Carolyn Sherif to discuss with us how their ideas came about and how they began their important research programs.

We also appreciate the help of our colleagues Mel Mark and Hoben Thomas for their careful reading of and critical suggestions on the chapters related to inferential statistics and survey research. Some of our colleagues at Penn State shared with us the manner in which they teach experimental methods as well as the values they wish to impart. In particular, we would like to thank Professors Paul Cornwell, Rick Jacobs, Jim Martin, Robert Seibel, and Robert Stern. There are many colleagues throughout the country who shared their experience of teaching with us and in many ways made this book richer. We appreciate these individuals. Some of these individuals presented careful readings of the earlier edition and make invaluable suggestions based on their experience with the book. In particular we would like to acknowledge Mark S. Sanders, California State University at Northridge;

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We hope the book has not suffered from our inability to implement all of their suggestions. We found the production staff at Wadsworth to be excellent and wish to thank them for their efforts. It is never an easy task to turn a manuscript into a finished product and such efforts often go unnoticed. We also appreciate our association with Ken King, the psychology editor at Wadsworth, for his commitment to this project and to quality publishing. We would also like to invite both students and faculty to write us with their comments concerning the book or examples from their courses or the literature that has helped to clarify the material. You can write us at the Department of Psychology, Pennsylvania State University, University Park, PA 16802.

INTRODUCTION

You are about to begin a voyage of wonder and curiosity, of questionings and doubts. Historically, it is a voyage that human beings began many generations ago and that young scientists like yourselves embark on every day. It is a voyage into the nature of ourselves and the world in which we live. It is a voyage with a particular focus: science. For some of you, science may offer a new way to view the world. Learning about science, like learning about anything new, will offer added perspective, which can in turn lead to a very real expansion of your own consciousness. For those of you already familiar with science, this book offers a deeper exploration of the science of behavior and experience. It is important to emphasize from the onset that learning about science is an expansion of what you already are. It is an *option,* an alternative that you are free to use or not to use as you explore and interact with our world. You choose how and when to use it. In fact, after taking this course, you may decide it is not a way you wish to view the world at all and you may never use it again!

Some beginning students are hesitant to explore science because they believe it is cold, antihumanistic, and even antireligious. They believe it separates us from our beliefs, our faiths, our feelings, and ourselves. This is a serious and limiting misconception. Many of our colleagues in all fields of science are as open to humanistic and spiritual traditions as they are to science. We believe that science—a science of behavior and experience—will some day assist us in a profoundly deep exploration of the inner teachings of all our great humanistic and spiritual traditions. This task of helping all of us more fully explore and understand our own potential may be the major function of science in the future evolution of human consciousness.

Our voyage into the science of behavior and experience begins by stressing that there are many childlike qualities that we hope will always remain

part of us. Genuine laughter, spontaneous play, intimacy, curiosity, and creativity are some childlike qualities that form the very foundation of mature human experience. In a similar way, the scientific method we are about to explore has firm roots in the simple way children go about exploring their world. With this in mind, we begin our exploration of science by viewing ourselves as children who wish to explore. The world awaiting the child includes not only the outside world but also the child's own psychological experience. Through this child, who is one aspect of ourselves, we approach the question of how we go about performing a science of behavior and experience. We will watch the child search for knowledge and mature into three distinct aspects, which we can define as actors in our drama of psychological inquiry.

The first aspect or role is that of the *scientist.* This is the role that you are reading this book to learn about. It is the active role in our drama. The task before you is to learn how the scientist goes about doing science. In this book we will watch the child learn the role of the scientist. We will come to see that many activities of present-day, mature scientists are simply extensions of the way we approached the world as children. As you learn about this role, you will learn about the types of questions scientists ask, the types of answers that they accept, and the manner in which knowledge is approached and verified. You will also learn how to assume this role for yourself and begin your drama of experimentation.

The second aspect or role is that of the *subject.* This is the passive role in our drama. The subject is the particular organism that the scientist chooses to study. In fact, it is the various experiences and behaviors of the subject that form the content of psychology. The paradox for scientists interested in the study of human behavior and experience is that although the subject matter is "out there" in the subjects we study, because we are also human, it is at the same time "in here" in us. In a very real sense, as we study other people and animals, we also study ourselves.

The third role is that of the *witness.* This role is not always recognized, yet in many ways it is the most important because it maintains a balance between the scientist and the subject, the active and passive aspects of this process. The witness, who is also us, stands back and watches the scientist do science and the subject behave and experience the world. One task of the witness is to teach that both the scientist and the subject are *limited* because each sees the world from his or her own perspective.

As the witness teaches us that there is a broader perspective from which we can appreciate both viewpoints simultaneously, we begin to mature and

realize the richness of the scientific process and the wonder of approaching knowledge of reality. In this vein, it is the role of the witness to remind us that the experience and understanding of life require more than just a description of miles of blood vessels, reinforcement schedules, and chemicals interacting with each other. It is the witness who asks whether the science of the scientist is relevant, ethical, and generally worth doing. But most important, it is the witness who brings together the procedures of the scientist and the experience of the subject and allows them to have a relationship in the first place.

Once we have developed these aspects of ourselves—the scientist, the subject, and the witness—we will be in a better position to understand the strengths and weaknesses of using science to study ourselves. Until that time, we would like to suggest that you neither accept nor reject the scientific approach but rather that you *allow* that it may have something to offer you. That is, you can allow yourself to become actively involved in trying to solve problems and answer questions using this method while remaining free to remember the problems and limitations of the scientific approach. As in anything else, it is only through active involvement that you will come to understand fully what the method has to offer. Let us now begin the drama of science with a problem—how did we as children come to know the world?—and from this develop methods for a science of behavior and experience.

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