

Ralph L. Rosnow. Robert Rosenthal

THIRD EDITION

Beginning Behavioral Research A Conceptual Primer

RALPH L. ROSNOW Temple University

ROBERT ROSENTHAL Harvard University



Library of Congress Cataloging-in-Publication Data

Rosnow, Ralph L.

Beginning behavioral research: a conceptual primer / Ralph L. Rosnow, Robert Rosenthal. — 3rd ed.

p. cm

Includes bibliographical references and indexes.

ISBN 0-13-791542-X (case)

1. Psychology—Research—Methodology. 2. Social sciences—Research—Methodology. I. Rosenthal, Robert.

II. Title.

BF76.5.R64 1998 300'.7'2—dc21

98-20614 CIP

Editor-in-chief: Nancy Roberts

Acquisitions Editor: Jennifer Gilliland

Assistant Editor: Anita Castro

Director of Production and Manufacturing: Barbara Kittle

Managing Editor: *Bonnie Biller* Project Manager: *Shelly Kupperman* Manufacturing Manager: *Nick Sklitsis*

Prepress and Manufacturing Buyer: Tricia Kenny

Art Director: Anne Bonanno Nieglos Interior/Cover Designer: Amy Rosen Line Art Coordinator: Guy Ruggiero Marketing Manager: Mike Alread

Cover Art: Elsa Warnick/Stockworks. Hand Holding Magnifying Glass Over Crowd/Stockworks

This book was set 10/12 Galliard Roman by the Clarinda Company (Atlantic) and bound by R.R. Donnelley & Sons (Harrisonburg). The cover was printed by Phoenix Color Corporation.



Copyright © 1999, 1996 by Prentice-Hall, Inc. Simon & Schuster/A Viacom Company Upper Saddle River, New Jersey 07458

All rights reserved. No part of this book may be reproduced, in any form or by any means, without permission in writing from the publisher.

Printed in the United States of America

10 9 8 7 6 5 4 3 2 1

ISBN 0-13-791542-X

Prentice-Hall International (UK) Limited, *London* Prentice-Hall of Australia Pty. Limited, *Sydney*

Prentice-Hall Canada Inc., Toronto

Prentice-Hall Hispanoamericana, S. A. Mexico Prentice-Hall of India Private Limited, New Delhi

Prentice-Hall of Japan, Inc., Tokyo

Simon & Schuster Asia Pte, Ltd., Singapore

Editora Prentice-Hall do Brasil, Ltda., Rio de Janeiro

To our students and colleagues in research methods past, present, and future

Preface

Beginning Behavioral Research was originally conceived as an undergraduate text for students who, as part of an introductory course in research methods, are required to plan an empirical study, to analyze and interpret data, and to report findings and conclusions. It is also intended to encourage students to be analytical and critical not only in interpreting research findings but also in seeing what is behind the claims and conclusions in news reports of scientific results. While the primary emphasis is on behavioral and social research, we make an effort to connect these disciplines with the empirical reasoning used in other fields in order to underscore the unity of science. We have been pleasantly surprised to learn that the text has also been successfully used in ways that go far beyond its original purpose. For example, it has been used in undergraduate courses in which the production of a research project was not a major goal, as well as by master's and doctoral students to slip into our advanced text, Essentials of Behavioral Research (1991). Lecturers at the University of South Africa (Unisa) have used Beginning Behavioral Research to teach psychological research to several thousand students in their distance learning program. We are gratified that the book has been found useful by so many.

Organization

As in earlier editions, the material in this edition is presented in a linear sequence corresponding to the steps involved in conducting an empirical research study and analyzing and reporting the results. The reader is led step by step through the following process:

1. Crafting a testable idea for research

Understanding empirical reasoning, the scientific method, levels of empirical investigation, and the scientific outlook (Chapter 1); creating, shaping, and polishing a research idea, and conducting a search of the literature (Chapter 2); weighing and balancing ethical considerations, and preparing a proposal for an ethics review (Chapter 3)

2. Choosing methods of data collection and measurement

Knowing what methods are available for watching and recording behavior in laboratory and field research, using archival data and outside observers (Chapter 4); collecting data in which the subjects describe their own behavior or state of mind (Chapter 5); assessing the reliability and validity of measuring instruments and research designs (Chapter 6)

3. Designing and implementing the research study

Designing a randomized experiment while controlling for artifacts and other threats to validity (Chapter 7); using time-series, *N*-of-1, longitudinal, correlational, and other designs (Chapter 8); surveying opinions and behavior, controlling for self-selection bias, and pilot-testing the instruments (Chapter 9)

4. Approaching the research data

Using graphics and statistical summary procedures to develop an overall picture of the results (Chapter 10); identifying relationships (Chapter 11); testing hypotheses, estimating effect size, creating a confidence interval around the obtained effect, using the BESD to interpret practical importance, and doing a power analysis (Chapter 12)

5. Testing hypotheses and exploring the results

Using t to compare two independent or two correlated conditions (Chapter 13); computing F in one-way and two-way designs, examining the simple effects, and interpreting an obtained interaction (Chapter 14); analyzing smaller and larger tables of counts by the chi-square and other procedures (Chapter 15)

- 6. Comparing and combining results of independent studies, doing a file drawer analysis (optional Appendix C)
- 7. Reporting the research project (Appendix A)

Our Approach

In our long experience of teaching research methods (over 60 years and several thousand students between the two of us), we have noted the questions and uncertainties of undergraduate students engaged in empirical research for the first time. The vast majority have not planned to pursue a career in research, but most of them have recognized the vitality and ubiquitousness of scientific research in their daily lives. So we have tried to anticipate and confront questions and uncertainties from their perspective not as potential professional producers of research, but as consumers of scientific results. It is essential for educated consumers to understand the utility and limitations of research as well as the fundamental differences between scientific and pseudoscientific claims of truth. Our aim in chronicling a wide range of older and newer research studies is to show the continuity of science. Once students have mastered this material, they should be able to understand more deeply what scientists mean when they proclaim that they have found something or not found something to be true.

Instructors who know our earlier work will recognize that this book—as well as our advanced text—grew out of a 117-page paperback book that we wrote many years ago: Primer of Methods for the Behavioral Sciences (Rosenthal & Rosnow, 1975a). Over the intervening period, we have had an opportunity to develop and refine that material. Most of our undergraduate students have been psychology majors required to take a research methods course as part of their concentration, but a substantial number have been in fields as diverse as communications, computer science, physical education, mathematics, statistics, accounting, nursing, biology, education, sociology, marketing, and even English, art, and theology. Whether they took this course as part of their major or as an elective, many dreaded the thought of having to wrestle again with statistics. On the assumption that few readers have total recall of statistics or will come away from a statistics course with an intuitive understanding of what was taught, we describe basic aspects of data analysis procedures, purposely avoiding the use of any mathematics beyond the high school level. We focus on the

most popular procedures, and also on convenient methods that can later be used outside the research methods course to examine the practical importance of a set of results.

Most students with no college training in statistics should find that they can master basic data-analytic skills by reading the chapters and repeating the exercises in the order in which they are presented. In this age of the computer, the speediest method of doing complex calculations is with the aid of a computer, yet as statistician John W. Tukey noted, much can be learned by simply changing our point of view and examining the data in different ways (e.g., exploring for moderator variables by using the stem-and-leaf procedure). Our philosophy of data analysis is to treat statistics (in Chapters 10–15 and Appendix C) by showing, through intuitive reasoning and simple examples, what the results tell us. Instructors who plan to teach students to perform their main calculations on a computer will find that our emphasis on the concrete and arithmetical aspects of data analysis will complement any statistics package they choose. We also describe useful data-analytic procedures that are not typically found in basic computer packages (e.g., the effect size correlation and the confidence interval around the effect, the method of standardizing the margins in chi-square tables, the isolation of interaction residuals, the detective-like probing of reported data for an unreported effect size, and the file drawer method of assessing robustness of an overall p value in meta-analysis).

Instructors familiar with Essentials of Behavioral Research will recognize that Beginning Behavioral Research can be used for students up to, but just below, the level of Essentials, and that the conceptual and philosophical treatment of methods and data analysis is similar in both texts. We again emphasize the utility of the Pearson r as an effect size measure that can be conveniently interpreted as an index of practical importance. We also introduce students to statistical power analysis in a way that many should be able to apply in their individual studies. The chapter on ethics is intended to raise questions that project well beyond this book. Students interested in advanced or more detailed analyses of the topics treated here will find discussions in Essentials. In both texts, we have sought to communicate the richness, diversity, and excitement (as well as the basic or advanced technical aspects) of human subjects research that we ourselves find so challenging and stimulating.

Special Features and Additions

In an effort to make this book more useful and more user-friendly to a wide variety of students, we have incorporated a number of pedagogical devices. Each chapter begins with a set of preview questions, which readers can refer to as they progress. Box discussions highlight and enliven concepts with practical examples and illustrations. Each chapter concludes with a summary of the main ideas, followed by a list of key terms pegged to particular pages, and finally a number of review questions to stimulate thought and discussion—both multiple-choice (new to this edition) and discussion questions, with the answers on pages 343–61. A revised glossary at the end of the book lists and defines all the key terms and notes the primary chapter(s) or appendix where each term is discussed. The Instructor's Manual, developed by David B. Strohmetz of Monmouth University, contains class-tested exercises, teaching tips,

xviii Preface

handout questions, and other ideas that complement each chapter and that can be used to stimulate discussion.

We again informally asked a number of instructors whether they preferred the sample report in Appendix A to be in the format of a journal submission (i.e., including compositor's notes and so on) or in the style of a term paper (i.e., with an appendix containing the student's raw data and calculations). Previously the responses had been about evenly split, but this time they favored the term paper a little more than the journal submission format. Nevertheless, we again show both formats, one based on the American Psychological Association's (1994) publication manual and the other based on Rosnow and Rosnow's (1998) guide to writing research reports and essays. Both sample reports follow the APA style in reference citations, nonsexist language, and other practical considerations.

Instructors familiar with the previous edition will find new boxes, new illustrative cases drawn from different areas of behavioral and social science, further polishing of statistical and other technical material, and, we hope, elimination of unnecessary redundancy. There is a new chapter on ethics, which takes as its point of departure an available draft (1996) of guidelines for researchers studying human behavior (American Psychological Association, 1997.) The chapters on randomized and quasiexperimental designs have been revised in response to comments that we have received from instructors. New to the statistical chapters is a discussion of the confidence interval of the effect size r, which was recommended in a number of recent articles (e.g., Cohen, 1994; Rosnow & Rosenthal, 1996a). We focus on the 95% interval but also show how to create and interpret a narrower or wider band. Instructors will find that our discussion of data analysis is consistent with the recommendations of the recent APA Task Force on Statistical Inference. While we do not focus on psychological constructivism or postmodernism in philosophy of science, there is a box on the former and a strong flavor of the latter in our discussion of aesthetics, visualizations, hidden presuppositions, and so forth. Students interested in broader aspects of the latter might be directed to A. I. Miller's Insights of Genius: Imagery and Creativity in Science and Art (Springer-Verlag, 1996) or, if interested in aspects of epistemological issues as viewed by practitioners of behavioral research, to R. L. Rosnow and M. Georgoudi's Contextualism and Understanding in Behavioral Science (Praeger, 1986).

Acknowledgments

We have benefited once again from working with David Strohmetz, who prepared the Instructor's Manual; Margaret Ritchie, who did the copy editing; and Mary Lu Rosenthal, who prepared the indexes. We are grateful for their creative, elegant, and helpful assistance. We thank Bruce Rind for again allowing us to include an edited version of his work in Appendix A and Steven Stern for his tips on using PsycLIT. We thank Martin Terre Blanche, René Van Eeden, Fred Van Staden, and Vivien Willers (all at the University of South Africa) for writing and perfecting the hundreds of test items that are available for use with this text. We thank Robert E. Lana for permission to borrow or adapt ideas from *Introduction to Contemporary Psychology* (Lana & Rosnow, 1972). We thank a long line of teaching assistants and students at Temple University and Harvard University for their valuable comments on and criticisms of the

lectures, handouts, drafts, and earlier editions on which this third edition was based. The first edition of this book was published by Macmillan Publishing Company, which was absorbed by Prentice Hall, and we thank the following consultants of these publishers for their constructive feedback: Bernard C. Beins, Ithaca College; Patricia R. DeLucia, Texas Tech University; Paul W. Foos, University of North Carolina at Charlotte; Allan J. Kimmel, American University of Paris; John W. Webster, Towson State University; Paul J. Wellman, Texas A & M University; and Jon L. Williams, Kenyon College. Additional valuable feedback was provided by an unusual trio of reviewers for Contemporary Psychology (1997, 42, 835–837). Three members of the academic community of Southern Illinois University each wrote a separate review of the second edition. In an act of unusual and creative packaging, one review was written by a professor, Jack McKillip; one was written by a graduate student, Kristin Duppong; and one was written by an undergraduate student, Laurel J. Tinsley, with only a minor in psychology. We thank them all for their ingenuity and for their helpfulness to us in preparing this third edition. We also thank Jennifer Gilliland, Bill Webber, and others at Prentice Hall for their editorial support. And finally, we thank Mimi Rosnow and Mary Lu Rosenthal for counseling us in ways too numerous to mention.

Certain tables, figures, and passages (specifically noted in the text) have by permission been reproduced in part or in their entirety, for which we thank the following authors, representatives, and publishers: E. Earl Baughman; Leonard Berkowitz; Jacob Cohen; Mihaly Csikszentmihalyi; J. A. Hagenaars; R. Vance Hall; Howard Kahane; Paul Slovic; Alan Sockloff; Laurence Steinberg; Robert Weisberg; Academic Press; American Association for the Advancement of Science; American Psychological Association; American Sociological Association; American Statistical Association; Biometrika Trustees of the Imperial College of Science, Technology and Medicine; Brooks/Cole Publishing Company; Cambridge University Press; Elsevier Science Publishers; Lawrence Erlbaum Associates, Inc.; HarperCollins Publishers; Helen Dwight Reid Educational Foundation and Heldref Publications; Holt, Rinehart & Winston; Houghton Mifflin Company; Iowa State University Press; Journal of Applied Behavior Analysis; McGraw-Hill, Inc.; W. W. Norton & Company, Inc.; Oxford University Press; Pergamon Press; The Rand Corporation; Sussex Publishers, Inc. and Psychology Today Magazine; The University of Chicago Press; Wadsworth Publishing Company; and John Wiley & Sons, Inc. We are also grateful to the Longman Group UK Ltd., on behalf of the Literary Executor of the late Sir Ronald Fisher, F.R.S., and Dr. Frank Yates, F.R.S., for permission to reprint Table V from Statistical Tables for Biological, Agricultural, and Medical Research (6th ed., 1974).

This is our 12th book together in a collaboration that began over 30 years ago, and the beat goes on!

Ralph L. Rosnow Robert Rosenthal

Contents

D C	
Preface	W 17
1 I Clace	XV

PART I GETTING STARTED

1 The Scientific Outlook 1

Preview Questions 1 Why Study Research Methods? Peirce's Methods of "Fixing Belief" What Is Empirical Reasoning? Empirical Reasoning in Behavioral Science 8 The Rhetoric of Science Other Shared Features of the Scientific Method 11 What Is Behavioral Science? 12 **Broad Research Approaches** Descriptive Research Relational Research Experimental Research 16 Orienting Attitudes of the Scientist Summary of Ideas 19 Key Terms 21 Multiple-Choice Questions for Review Discussion Questions for Review 22

2 Strategies of Discovery 24

Preview Questions 24

The Stages of Discovery 24

The Initial Thinking Stage 26

Using an Intensive Case Study 26

Making Sense of a Paradoxical Incident 28

Using Metaphors and Analogies 28

Resolving Conflicting Results Improving on Older Ideas Exploiting Serendipity The Plausibility Stage Focusing and Assessing Ideas 36 Avoiding Plagiarism and Lazy Writing 36 Searching the Literature PsycLIT and Machine-Readable Databases Defining Terms and Variables A Summary Illustration The Acceptability Stage 44 Theories and Hypotheses 44. Molding Ideas Into Acceptable Hypotheses Constructs and Variables Examples of Independent Variables Examples of Dependent Variables Discovery as Exploration Summary of Ideas Key Terms 53 Multiple-Choice Questions for Review 54 Discussion Questions for Review

3 Ethical Considerations 57

Preview Questions 57 What Are Ethical Guidelines? Principle I. Respect for Persons and Their Autonomy Principle II. Beneficence and Nonmaleficence Principle III. Justice 64 Principle IV. Trust Principle V. Fidelity and Scientific Integrity 66 Deception Milgram's Use of Deception 68 70 Is Deception Ever Justified? Debriefing Participants The Use of Animals in Research Ethical Issues Throughout the Research Process 75 Summary of Ideas Key Terms 77 Multiple-Choice Questions for Review 77 Discussion Questions for Review

PART II OBSERVATION AND MEASUREMENT

4 Systematic Observational Methods 80

Preview Questions The Researcher as Observer Naturalistic Observation Participant-Observer Research 83 Ethnographic Research Content Analysis of Archival Data 88 The Laboratory Experiment Rival Interpretations The Field Experiment 93 Reactive and Nonreactive Observation Unobtrusive Observation 96 Using Judges as Observers A Final Note 99 99 Summary of Ideas Key Terms 100 Multiple-Choice Questions for Review Discussion Questions for Review

5 Self-Report Methods 103

Preview Questions 103 Looking Within Oneself 103 Three Basic Considerations 105 Open-Ended versus Closed Questions Projective Measures of Personality Structured Measures of Personality Numerical Scales 109 Forced-Choice Scales 112 Graphic Scales 113 Rating Errors and Their Control 113 The Semantic Differential The Likert Scale 118 The Thurstone Scale 118 Pilot-Testing Your Questionnaire 122 Interviews versus Questionnaires Planning and Pilot-Testing the Interview 123

viii CONTENTS

The Critical Incident Technique 125
Interviews by Telephone 127
Memory and the Use of Behavioral Diaries 128
Summary of Ideas 130
Key Terms 131
Multiple-Choice Questions for Review 132
Discussion Questions for Review 133

6 Reliability and Validity 134

Preview Questions Random and Systematic Error 134 Reliability 135 Test-Retest Reliability 135 Internal-Consistency Reliability 137 What Is Acceptable Reliability? Applications to Reliability of Judges Using a Table of Estimated Values Replication and Reliability 144 Validity 145 Content Validity 145 Criterion Validity Construct Validity 147 Detailed Example: Crowne and Marlowe's Research Validity in Experimental Design 152 Summary of Ideas Key Terms 153 Multiple-Choice Questions for Review 154 Discussion Questions for Review

PART III DESIGN AND IMPLEMENTATION

7 The Logic of Randomized Experiments 156

Preview Questions 156
A Basic Framework 156
Random Assignment of Subjects 158
Four Kinds of Causation 161
Three Criteria of Efficient Causation 162
Uncertainty of Causal Inference 163
Mill's Methods and the Logic of Experimental Control 164

Teasing Out Effects of Interest 165

The Solomon Design 166

Preexperimental Designs 168

History, Maturation, Instrumentation, and Selection 169

The Social Psychology of the Experiment 170

Subject-Related Artifacts 171

Experimenter Expectancy and Its Control 173

Summary of Ideas 175

Key Terms 176

Multiple-Choice Questions for Review 177

Discussion Questions for Review 178

Preview Questions 180 The Role of Quasi-Experimentation 180 Nonequivalent-Groups Designs Inferring Causation and Moderation 183 Interrupted Time-Series Designs Single-Case Experimental Designs 189 Alternative Single-Case Designs Correlational Designs Cross-Lagged Panel Designs Longitudinal Designs Using Cohorts 196 Summary of Ideas Key Terms 200 Multiple-Choice Questions for Review 200 Discussion Questions for Review

9 Survey Designs and Subject Recruitment 203

Preview Questions 203
Selecting the Research Participants 203
Basic Concepts in Survey Samples 205
Simple Random Sampling 207
Random Sampling Options 210
Stratification in Sampling 211
Area Probability Sampling 211
Lessons Learned by George Gallup 212
Point and Interval Estimates 214

CONTENTS

X

Benefits of Stratification 215
Estimating the Bias Due to Nonresponse 217
Increasing the Rate of Response 219
Characteristics of Volunteer Subjects 219
Implications for Research Conclusions 221
Increasing Participation and Ethical Accountability 223
Pilot Testing as a Final Step 223
Summary of Ideas 224
Key Terms 225
Multiple-Choice Questions for Review 225
Discussion Questions for Review 226

PART IV DESCRIBING AND HYPOTHESIS TESTING

10 Summarizing the Data 228

Preview Questions 228 Statistical Procedures 228 Visualizing Data 229 Stem-and-Leaf Displays Percentiles and the Median Applying What We Have Learned 234 The Mode and the Mean 236 Dealing With Outliers 237 The Crude and Extended Range The Variance and the Standard Deviation Descriptive and Inferential Formulas The Normal Distribution Standard Scores 243 Comparing Standard Scores 244 Summary of Ideas 245 Key Terms 246 Multiple-Choice Questions for Review 247 Discussion Questions for Review

11 Examining Relationships 249

Preview Questions 249
The Correlation Coefficient 249

Visualizing the Correlation Coefficient 251
Calculating the Pearson r 253
Spearman Rank Correlation 255
Point-Biserial Correlation 259
Phi Coefficient 261
A Final Note 263
Summary of Ideas 263
Key Terms 264
Multiple-Choice Questions for Review 264
Discussion Questions for Review 265

12 Statistical Significance and Practical Importance 267

Preview Questions 267 Use of Statistics and Probabilities The Null Hypothesis in Significance Testing Probability Revisited 270 Type I and Type II Errors Risks of Gullibility and Blindness Finding the Significance of r=274276 Binomial Effect-Size Display (BESD) 279 Please Don't Square the Effect Size! Statistical Power Analysis Constructing a Confidence Interval 282 Summary of Ideas Key Terms 285 Multiple-Choice Questions for Review Discussion Questions for Review

PART V STATISTICAL DECISION MAKING

13 The t Test 288

Preview Questions 288
Comparing Two Means 288
Signal-to-Noise Ratios 289
Comparing Independent Samples 291
Using the *t* Table to Find *p* 293
Measuring the Effect Size 295

xii Contents

The Confidence Interval and the BESD 297
Optimizing the t Test 297
Comparing Related Samples 299
Summary of Ideas 302
Key Terms 302
Multiple-Choice Questions for Review 302
Discussion Questions for Review 303

14 The F Test 305

305 **Preview Questions** F and t 305 The Logic of ANOVA Dividing Up the Variance 308 Computing the One-Way ANOVA The ANOVA Summary Table 310 Using the F Table to Find pAfter the *F*, *t* Revisited 314 Two-Way Designs Effects and the Factorial ANOVA 318 The Concept of Error Computing the Two-Way ANOVA Repeated-Measures ANOVA Designs Summary of Ideas 324 Key Terms Multiple-Choice Questions for Review 325 Discussion Questions for Review

15 Chi-Square 328

Preview Questions 328
The Utility of Chi-Square 328
Computing 2 × 2 Chi-Squares 329
Finding the p Value, Effect Size, and Confidence Interval 332
Phi and Chi-Square 334
Larger Tables of Counts 335
Interpreting Large Tables 336
Taking the Margins into Account 337
A Journey Begun 339