A RESEARCH PRIMER FOR THE SOCIAL AND BEHAVIORAL SCIENCES

Miriam Schapiro Grosof
and Hyman Sardy
A
Research Primer
for the
Social and Behavioral Sciences
A RESEARCH PRIMER for the SOCIAL AND BEHAVIORAL SCIENCES

Miriam Schapiro Grosof  
Yeshiva University  
and  
Pace University  
New York, New York

Hyman Sardy  
Brooklyn College  
Brooklyn, New York

1985

ACADEMIC PRESS, INC.  
(Harcourt Brace Jovanovich, Publishers)  
Orlando San Diego New York London Toronto Montreal Sydney Tokyo
Contents

Preface xiii
Acknowledgments xv

Introduction 1
Appendix: Decision Trees 5
Notes 7

1. Preliminaries
   Introduction 9
   Methods of Acquiring Knowledge 10
   The Scientific Method 11
      Identifying a Problem as Researchable 12
      The Role of Theory 13
      Causality 15
      Controlled Observations 16
      Statistical Analysis 17
      Overview of the Scientific Method 18
   Classification of Research 18
      Formulative and Verificational Research 18
      Basic, Applied, and Action Research 19
   Notes 21
   Additional Reading 22

2. Choosing the Research Problem and Stating the Problem-Question
   The Importance of a Well-Chosen Problem 25
   Sources of Problems 25
   The Role of Curiosity 28
   A Theoretical Basis for the Study 29
   Originality 34
   Amenability to Replication 34
   Practical Aspects of Problem Formulation 35
      Time 35
      Costs 36
      Availability of Other Resources 37
      Availability of Information 38
Usefulness of the Findings 39
Politics of Problem Selection 39
Political Problems Peculiar to Doctoral Students: The Committee 40
Capabilities and Limitations of the Researcher 41
Stating the Problem-Question: Avoiding Common Errors in Formulation 42
A Research Plan 44

Design: Preliminaries 44

Trouble: The Best-Laid Plans . . . 45
Appendix: Difficulties Nobody Mentions Because They Figure You Shouldn't Have To Be Told (Maybe You Don't) 46
Notes 48
Additional Reading 49

3. The Background of the Problem:
Review of the Literature

Introduction 51
Locating Reference Materials: Bibliographic 52
Reviewing and Abstracting 54

Checklist for Evaluating the Report of a Study 55
Locating Reference Materials: Other Researchers 56
Format: Notes and Bibliography 57
Recording and Storing Bibliographic Material 57
When to Stop 58
Common Errors 60
Outcome of the Background Search 60
Appendix: Research Indexes 61
Notes 61
Additional Reading 62

4. Definitions and Major Research Hypotheses

Introduction: The Relationship between Theory-Building and Hypothesis-Testing 63
Role of Definitions in Hypothesis Formulation 64
Selection of Variables and Identification of Their Role in the Hypothesis 67
The Hypothesis: What Is It? 69
Stating the Expected Relationships 71
Operationalizing Definitions and Hypotheses 73
The Logic of Hypothesis Testing 75
The Null Hypothesis 77
Level of Significance, Region of Rejection, and Type I or α-Error 78
Type II or β-Error 79
One-Tailed versus Two-Tailed Tests (Directional versus Nondirectional Effects) 80
When Significance Tests Are Not Appropriate or Useful 82
A Final Word 83
Notes 83
Additional Reading 85
5. Evaluating Method and Design

Introduction 87
Classification of Research 88
Control 91
Internal and External Validity 93
Control of Variance 95
Common Sources of Invalidity in Practice 99
Notes 101
Additional Reading 102

6. Research Types

Introduction 103
Nonexperimental Research Types: Historical 104
Nonexperimental Research Types: Descriptive 109
1. Longitudinal Studies 110
2. Case and Generalized Case Studies 112
3. Correlational Studies 114
4. System Studies 116
Experimental Research Types 119
Overlapping Research Types 125
Pilot Studies 127
Summary 128
Notes 128
Additional Reading 130

7. Procedure: Measurement, Instrumentation, and Data Collection

Introduction 133
Measurement 133
Stevens' Classification of Scales 134
Other Ways to Classify Scales 137
Scales and Statistics 138
Instruments 140
Direct Observation 141
Equipment 142
Questions and Schedules 143
Some Vocabulary 151
Questions 151
Scaling: Constructing Scales 152
Indexes 154
Normative and Ipsative Scoring 155
Criteria for Evaluating Instruments 156
Validity 156
Reliability 159
Standardization 161
Sensitivity and Differentiability 161
The Role of Measurement and Instrumentation 162
Problems of Developing Your Own Instrument 162
Notes 164
Additional Reading 166

8. The Study Population: Sampling

Introduction 169
Sampling: Advantages and Disadvantages 172
Nonprobability Sample Types 172
Estimation Based on Probabilistic Sampling 174
Determining a Sampling Procedure: Initial Steps 175
Sampling Types 176
   * Simple Random Sampling 176
   * Stratified Sampling 176
   * Systematic Sampling 177
   * Cluster Sampling 178
   * Matched Samples 179
   * Two-Phased Sampling 179
   * Sequential Sampling 180
   * Interpenetrating Replicate Subsampling 180
Other Sampling Types 181
Determining Sample Size 181
Sampling Errors to Avoid 185
Sampling and Studying Human Populations 186
Sampling and External Validity: A Concluding Note 187
Notes 188
Additional Reading 189

9. Role of Computer in Research

Computer Processing of Data 191
Some Basic Computer Terminology 192
Access to Computing Facilities 192
Who Processes Your Data? 194
Computer Costs 195
Timely Processing 195
Coding and Documentation 197
Computerizing Input Information 198
Verification of Input Information 199
Security of Machine-Readable Information 199
Automated Data Acquisition and Process Control 200
Data Base Management (Management Information) Systems and
   Computer Simulation (Automated Data Generation) 200
Your Own Software 202
Computer Packages for the Social Sciences 202
Computer Graphics 204
Text Editors 204
Keeping Data Records (Archiving) 205
Notes 206
Additional Reading 206
## 10. Techniques for Analysis of Data

- **Introduction** 207
- **A Note on Word Usage** 208
- **Questions That Data Analysis Can and Cannot Answer** 208
- **Experts** 210
  - *Choosing and Using a Statistical Resource Person or Consultant* 210
  - *Choosing and Using a Computer Resource Person* 212
- **Classification of Data Analysis or Statistical Techniques** 213
- **Evaluating Competing Procedures** 217
- **Computer Use** 218
- **Decision Trees for Choosing Statistical Procedures** 219
- **Notes** 220
- **Additional Reading** 221

## 11. Probabilistic Methods: Univariate and Bivariate Statistics

- **Introduction** 223
- **Graphs and Charts** 223
  - *Bar Charts* 224
  - *Line Plots or Line Charts* 225
  - *Scattergrams* 227
  - *Pie Charts* 227
  - *Exploratory Graphing Techniques* 227
  - *Statistical Maps* 229
  - *Miscellaneous Schematic Graphs* 230
- **Tables** 230
- **Percentages** 233
- **Cross Sorts and Cross Breaks** 233
- **Univariate Measures and Techniques** 235
- **The Measurement of Difference** 246
- **Measurement of Relationships and Strength of Association** 256
- **Nonparametric Relationships** 264
- **Afterword** 266
- **Notes** 267
- **Additional Reading** 268


- **Introduction** 271
- **Charts and Tables for Three or More Variables** 272
- **Multiple Causality** 276
- **Partial and Semipartial (Part) Correlation** 282
- **Multiple Regression Analysis** 284
  - *Least Squares Assumptions* 285
  - *Nonlinear Regression: Transforming (Re-Expressing) Variables* 287
  - *Path Analysis* 291
- **The Analysis of Variance (ANOVA)** 292
  - *Assumptions Underlying Analysis of Variance* 293
n-Way Analysis of Variance and Factorial Design 295
Other Types of Design 300
Analysis of Covariance (ANCOVA) 300
Multiple Comparison Procedures 302
Notes 304
Additional Reading 306

13. Probabilistic Methods: Multivariate Statistics II: Clustering and Classification Techniques
Introduction 309
Factor Analysis 309
Discriminant Analysis 317
Assumptions and Procedures 318
Interpreting Discriminant Functions 320
Classification of Cases 321
Calculating Procedures 321
A Last Word on Discriminant Analysis 326
Canonical Correlation Analysis 326
Multivariate Linear Methods: Some Comparisons 331
Notes 335
Additional Reading 337

Introduction 339
Time Series: Special Issues in Bivariate and Multivariate Analyses 339
Nonparametric Multivariate Methods 342
Introduction 342
Nonparametric Analysis of Variance (Kruskal-Wallis and Friedman Tests) 343
The Coefficient of Concordance 347
Cochran's Q Test 347
The Chi-Square Tests 348
Partialling Procedures 352
Some Last Thoughts on Multivariate Statistical Techniques 353
Notes 353
Additional Reading 354

15. Deterministic Problem Analysis Techniques
Introduction 357
Elementary Mathematical Techniques 358
Calculus Based Techniques 359
Mathematical Programming 361
Linear Programming 361
Integer Programming 364
Parametric Programming (Sensitivity Analysis) 364
Nonlinear Programming 364
Dynamic Programming 365
## Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network Models</td>
<td>366</td>
</tr>
<tr>
<td>PERT</td>
<td>366</td>
</tr>
<tr>
<td>Critical Path Method (CPM)</td>
<td>368</td>
</tr>
<tr>
<td>Decision Theory</td>
<td>369</td>
</tr>
<tr>
<td>Finite Markov Chain Processes</td>
<td>373</td>
</tr>
<tr>
<td>Inventory Models</td>
<td>374</td>
</tr>
<tr>
<td>Waiting Line (Queueing) Models</td>
<td>375</td>
</tr>
<tr>
<td>Afterword</td>
<td>376</td>
</tr>
<tr>
<td>Notes</td>
<td>376</td>
</tr>
<tr>
<td>Additional Reading</td>
<td>378</td>
</tr>
</tbody>
</table>

### 16. Endgame

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluating the Design of Your Study</td>
<td>379</td>
</tr>
<tr>
<td>The Overall Structure of the Report</td>
<td>381</td>
</tr>
<tr>
<td>Review of Related Literature: Suggesting the Importance of the Study</td>
<td>381</td>
</tr>
<tr>
<td>Presentation of Design and Methodology</td>
<td>382</td>
</tr>
<tr>
<td>What To Make of It</td>
<td>383</td>
</tr>
<tr>
<td>The Statement of Findings</td>
<td>386</td>
</tr>
<tr>
<td>What Are Findings</td>
<td>386</td>
</tr>
<tr>
<td>Presentation of Findings</td>
<td>387</td>
</tr>
<tr>
<td>Common Errors in Presentation of Findings</td>
<td>389</td>
</tr>
<tr>
<td>Your Conclusions</td>
<td>390</td>
</tr>
<tr>
<td>Recapitulation of Problem Statement</td>
<td>390</td>
</tr>
<tr>
<td>Critical Comment: Implications and (General) Discussion</td>
<td>391</td>
</tr>
<tr>
<td>Resolution of Contradictions</td>
<td>392</td>
</tr>
<tr>
<td>Negative Results</td>
<td>393</td>
</tr>
<tr>
<td>Your Summary</td>
<td>394</td>
</tr>
<tr>
<td>Journal Articles: Special Considerations</td>
<td>394</td>
</tr>
<tr>
<td>Evaluation Reports: Special Considerations</td>
<td>395</td>
</tr>
<tr>
<td>Pitfalls in Presentation of Conclusions</td>
<td>396</td>
</tr>
<tr>
<td>The Research Report: Recapitulation</td>
<td>397</td>
</tr>
<tr>
<td>Developing a Readable Style</td>
<td>397</td>
</tr>
<tr>
<td>Afterword</td>
<td>399</td>
</tr>
<tr>
<td>Appendix: Dissertation Checklist</td>
<td>400</td>
</tr>
<tr>
<td>Notes</td>
<td>401</td>
</tr>
<tr>
<td>Additional Reading</td>
<td>402</td>
</tr>
</tbody>
</table>

References 405

Index 425
Preface

This book is directed to novice investigators in the broad category "social and behavioral sciences" who are already knowledgeable in their respective disciplines and whose research problems primarily concern human subjects, yield quantitative or quantifiable evidence, and involve statistical or related procedures for the analysis of that evidence. Most researchers, unless they have had years of experience, possess substantial technical skills but may need help in coordinating them or in filling in uneven preparation. Moreover, they may want to use as yet unfamiliar methodologies from related areas. Research requires a shift in attitudes and expectations from the patterns of earlier training; we outline the research process as a whole and emphasize the importance of organizing information and planning sequences of tasks. We discuss the selection of methodologies, not the details of their use. We cover such fundamental matters as how to choose a research topic and evaluate its suitability. Our approach is practical rather than sentimental or inspirational, because we believe that the best incentive to continue in a productive career is the successful completion of a commendable first project.

This book had its genesis in our experiences, working with doctoral students and other beginning researchers, over a period of several years, variously as instructor in statistics and research courses, principal dissertation advisor, committee member, informal and formal consultant, and friend. We believe the research task to be amenable to rational analysis. The needs for assistance in the decision-making aspect of research, and for an overview of how the many component pieces fit together in the entire process, seemed to us to be urgent for many individuals. We have tried to meet these needs in a way which combines common sense and sophisticated erudition.
Acknowledgments

In this ambitious endeavor we have relied upon the contributions of many others. (Any errors and shortcomings are of course our own.) Richard A. Stein and Gerald Marotznik generously permitted us to use their data set. Elisa Adams edited the final draft of the manuscript with elegance, wit, and skill. Kathleen O’Donnell-Maguire typed and retyped with extraordinary diligence and meticulous accuracy.


Also, for support and encouragement before and during the writing, we thank: Benjamin N. and David H. Grosof, Ernest Kafka, Donald J. Newman, Lillian Milgram Schapiro, Meyer Schapiro, and Shulamith Simon.

Last and most, we acknowledge with deep gratitude the participation of Gene S. Fisch and Susan J. Sardy, for their loving good humor, for their effort in helping us get the project under way, for reminding us continually of its value, for constantly challenging us to refine our ideas and their presentation, and for “being there” with reinforcers.
This page intentionally left blank
Introduction

"We face insurmountable opportunities"

Pogo (Walt Kelly)

This book is entitled A Research Primer for the Social and Behavioral Sciences. Traditionally, a primer is intended for beginners; it is gentle and friendly in tone; it offers an introduction to some domain of knowledge in a simple and direct way, and provides some suggestions for learning more about it, usually through further, more intensive reading. This primer is perhaps somewhat unusual in that it is addressed to individuals who have already acquired at least a fair degree of knowledge or expertise in one of the social or behavioral sciences. They may, nonetheless, need guidance in undertaking that most difficult of tasks, independent original research.

The goal of this book is threefold: to provide you with

- an introductory but comprehensive overview of the research process,
- a description of the difficulties you will probably encounter and the skills you will have to master in order to overcome them, and
- a discussion of differing and possibly conflicting points of view concerning certain aspects of your task.

We delineate the different facets of research, and offer guidelines for formulating and managing the interdependent procedures needed to attack your research problem. We make no attempt to duplicate the many excellent works on specific topics: manuals of design, textbooks on statistics, expositions of philosophy or methodology in the various social sciences, and handbooks of style, etc. We see this book as a primer of research concepts, not of techniques, and not directed to any one discipline. It deals with questions that arise in applied or cross-fields and that require researchers to integrate or decide among the methodologies and viewpoints of several different disciplines. It is not a book of "know-how." It is certainly not encyclopedic and does not pretend to be.

The book is for you if you are undertaking a first research project in your own or a related field in the social or behavioral sciences, be it a doctoral dissertation or a substantial master's thesis, senior honors, or major area paper.
Among the social and behavioral sciences we include social psychology, sociology, certain aspects of individual psychology (e.g., clinical, human learning, child and adolescent development), political science, anthropology, economics, history; also all the applied social relations (multidisciplinary or interdisciplinary) fields such as education, ethnic, area and women's studies; the health sciences such as delivery of medical care, epidemiology, kinesics, and public health; human ecology, social work, and theory of management. We also include certain work in linguistics and analysis of style and period in the arts. We assume your research question is primarily concerned with human behavior, and exploits the application of statistical or related quantitative methods in the analysis of evidence.

We make certain assumptions about you, the reader, in addition to those mentioned above concerning fields of interest.

- You are sufficiently knowledgeable about the discipline within which the problem lies (e.g., education, sociology, public health) so as to be aware of related problems, fundamental definitions, pertinent theories. (You may, however, be unfamiliar with strategies of data collection and analysis more typical of work in other disciplines but quite adaptable to problems in your own.)
- You are able to obtain access to such needed facilities as calculating devices, a library, etc.
- You are informed about statistics to the extent of an intensive 1-year course and reasonably unperturbed at the prospect of learning and using additional techniques.
- You are oriented towards research as a problem-solving enterprise, whether the desired outcome is primarily theoretical or practical.
- You are energetic, persistent, and willing to assign a high priority to the research project for its duration: in other words, strongly motivated.

Many people find the prospect of undertaking their own research overwhelming. Why is this so?

- New researchers are neither selected nor trained for this set of tasks. Their earlier training, which may have concentrated on another field, emphasized different skills, those that are relevant to course work. In addition, it may have been very uneven or have taken place long ago. Throughout the college and earlier graduate years, retention and the ability to summarize and synthesize the work of others were emphasized. The shift from being consumer to producer of research is the shift from asking “What is known?” to “What do I want (or need) to know?” Formulating a coherent proposal for a research project and laying out the methodology can be formidable: It requires keeping several balls in the air at the same time.
Beginning researchers frequently do not know which skills they need, nor how to acquire them. They are often uncertain about what is expected of them. Their most important—and perhaps most difficult—task is learning to take responsibility for their own work, to develop and use their own critical ability rather than depending on the traditional "grading" by an authority. Doing this involves willingness to undertake a risk.

To address these concerns, this primer outlines the research process as a whole, from the initial selection of a problem area, through problem formulation, identification of variables, development of design, decisions about sampling and instrumentation, exploitation of the computer, choice of statistical analysis, and finally presentation of findings. It describes the steps involved under each of these headings, with particular attention to the interdependence of decisions and warnings of common pitfalls. It indicates what skills the researcher will need, and which can be best obtained in the form of a consultant's services. Although each chapter deals with its topic in some detail, the book's main purpose is to convey the importance of intelligent choice among alternatives.

We emphasize the importance of organizing information for research purposes.

We stress the decision-making that goes into research, not how to use specific techniques but when to use them. We make a consistent effort to employ terminology that will be compatible with usage in all, or at least several, disciplines.

Research requires asking as well as answering questions. It requires a skeptical rather than an accepting attitude towards intellectual authority.

This primer emphasizes the need to accomplish a major shift in attitudes about knowledge. It consistently describes the research process as a set of plausible procedures together with a set of questions to be answered, and emphasizes that the investigator's choices among these alternatives determine and characterize the particular piece of research.

This book is practical in its approach. It emphasizes realistic estimates of time, money, and other resources, and careful planning of procedures so as to make the most effective use of whatever is available. Almost everyone operates under constraints of time and money. Research is an open-ended enterprise: unlike the set curricula for the training of lawyers and physicians, it offers no guarantee of completion at the end of a fixed time.

This book acknowledges the inevitable difficulties instead of implying that their occurrence is somehow the beginner's fault. Here are some facts of life we recognize and take into account: finding sources, checking references, revising endlessly, setting up calculations, and summarizing
statistical results are frustrating tasks; rewriting can be tedious; finding the appropriate way to state what seems already obvious may be very difficult, especially if one finds writing burdensome; the problem may be elusive and difficult; unexpected snags may develop; the researcher, having lost some initial enthusiasm, may become impatient; subjects may be uncooperative, supervisors who give permission may change their minds (or their assignments); books may mysteriously disappear from the library that has the only copy within 200 miles, etc., etc. A heavy investment must be made in a search for what often turns out not to be there.

Researchers cannot depend on external approval as a source of motivation. Neither is there usually available an ongoing collaboration from which they can obtain the social support to which they may be accustomed. Friends and family may not understand their work or even why it is worth doing. Researchers must set their own standards and proceed in a frequently lonely enterprise.

Finally, beginning researchers are likely to be intimidated by examples of “great research.” While there is much to be said for ambition and elevated goals, it is painful to have to accept the greater wisdom of striving to do a workmanlike job on a well-defined and contained problem whose solution is valuable and interesting.

We address these concerns directly. We make every effort to assist you to develop a sense of proportion—and a sense of humor—about the enterprise in which you are entangled. We do not minimize the uncertainty or the gratuitous character of some of the snags that may impede your progress. This is likely to relieve some of your “it’s just me” feelings of inadequacy. We believe that straightforwardness about certain problems is helpful even when no direct solutions can be offered.

For convenience, we frequently refer to the beginning researcher as the student, using this in both the specific sense of graduate (or undergraduate) student and the more general one of learner. We hope any necessary distinction will be self-explanatory. We almost always mean the authors; very occasionally it means “the profession.” He should be understood as he or she unless the antecedent is clearly male. You means you, the reader.

The best way to use this book is to read the table of contents and the preface, skim the first few paragraphs of each chapter, then return to read more carefully the chapters that seem most relevant to your interests and state of progress. Some of the “philosophical” material seems very simple and the “statistical” very difficult, but it is important not to confuse technical and profound.
Appendix: Decision Trees

Despite the informal style, some parts need to be studied very closely. (If you are an aural learner, try reading difficult bits out loud.) You will probably find it helpful to reread certain chapters and to consult the list of references.

The chapter on writing up your results serves as a general guide. Superb models (as well as an assortment of horrible examples) are undoubtedly available in the literature of your own field. In this book, we cite many studies, some quite popular; not all are good ones but all serve an exemplary purpose.

At the end of most chapters, in addition to the usual notes, a briefly annotated list of additional reading is given. These include general (elementary) reference texts, specialized technical manuals, and special reference texts, or specialized chapters thereof. We have tried to indicate their potential for direct usefulness. We are not including research reports and material prepared for professional colleagues with the same or related academic research specialty. All authors mentioned in the text, notes, or reading lists appear with full citation in the bibliography.

Appendix: Decision Trees

We will make frequent use of decision trees.

A decision tree is a graphic representation of decision procedure. To be practicable, it must consist of a finite number of steps (but not too many, one hopes). Each step presents a finite number of alternatives, exactly one of which must be selected. The alternatives at any step or branch point should (1) be mutually exclusive and (2) exhaust the universe of possible alternatives at that step, that is, every possible alternative should appear. Put in terms perhaps more familiar, a decision tree is a flow chart for decision-making. A simple example will illustrate the conventions (see Figure 0.1).

Start at the left of Figure 0.1 and read across. (Other trees may start at the top and work down to take advantage of available space.) Note that at each branch point, exactly one alternative applies; there is no “missing case” and no overlap of cases. For example, in our Figure 0.1, “The Bedtime Snack,” you start at the initial question, “Are you thirsty or hungry?” Your answer can only be yes or no. If your answer is no, proceed to the branch or arrow which terminates with the command, “Brush teeth now.” If your answer is yes, you can ask the next question, “Are you thirsty or hungry?” Follow the branch corresponding to the selected alternative until you reach the next branch point and repeat the decision procedure. In a more general setting, a branch may connect (loop or bridge) to another branch or even to another parallel tree. Referring again to Figure 0.1, suppose you had come out of “The Bedtime Snack” by satisfying your thirst with a root beer; a branch could be
FIGURE 0.1 Decision tree: The bedtime snack.