HARDYCK AND PETRINOVICH

UNDERSTANDING RESEARCH IN THE SOCIAL SCIENCES

SAUNDERS BOOKS IN PSYCHOLOGY

UNDERSTANDING RESEARCH IN THE SOCIAL SCIENCES

A PRACTICAL GUIDE TO UNDERSTANDING SOCIAL AND BEHAVIORAL RESEARCH

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preface

A great many people contribute to the writing of a book; some knowingly, some not. The idea for this book originated with the first author one winter afternoon while listening to a colleague tell him at great length about how she had been mistreated by the university administration. The connection between her narrative and the germination of this book was unanalyzeable then and remains so now. This colleague is certainly deserving of thanks, although, given the circumstances, she would probably prefer to remain anonymous, as she will.

Of equal importance and anonymity are two of the five reviewers of the first manuscript submitted to the publisher. Two of the reviews were mildly favorable, one was petulantly opposed, and one was so devastating in its detailed criticism as to provoke homicidal thoughts in both authors. However, after a cooling-off period, that reviewer's comments stimulated a drastic and extensive revision, resulting in a greatly improved manuscript. A fifth review, following the drastic revision, resulted in still more changes and modifications. We owe much to these two constructively critical reviewers.

Not all influences are positive. Much of the first draft of this book was written in the summer of 1971 in the village of Lindos, Rhodes, Greece, where an especially hot summer made typing after 11 A.M. as much an exercise in not dripping sweat into the typewriter as in composing. Among negative influences, the Island customs authorities deserve special mention for impounding needed reference books—statistics texts—for five weeks while examining them for possible subversive content. Other influences (divorce, foreign travels, and similar vagaries of modern life) conspired to delay the completion of this work until the present date.

Fortunately, many contributions are positive and can be identified. Baxter Venable, Psychology Editor for the W. B. Saunders Company, was both encouraging and supportive. Professor Robert Singer, the consulting editor, deserves thanks for his help on numerous occasions.

We would like to thank Professors Ramon J. Rhine, Sarah J. Hill, Susan E. Wandruff, Leonard A. Marascuilo, Kathleen Penfield, David L. Rosenhan, William D. Rohwer, Jr., Steve Lynch, Alan S. Kaufman, and Nadeen L. Kaufman for permitting us to reprint from their published work and comment

on it. We are grateful to the trustees of *Biometrika*, who permitted us to paraphrase a 1930 publication by "Student."

Professors William Rohwer and Leonard Marascuilo also assisted the authors by abridging their articles and by reviewing our commentary. Professor Henry Kaiser reviewed our chapter on factor analysis and Professor Roy Goldman our chapter on multivariate analysis, and we would like to express our gratitude. A special note of thanks is due Professor Marida Hollos, who, in addition to permitting us to quote from her field studies of Norway, reviewed the chapter on field observational methods and allowed us to use her research data for the majority of examples in our chapter on multivariate statistical methods.

Typing a book containing symbols is a constant battle against error. For producing an error-free manuscript and also for spotting errors we overlooked, we are most appreciative of Edith Lavin's help.

Usually a preface has something to say about the purpose of the book. However, we are firmly committed to the belief that no one ever reads a preface. The purpose of this book will be made clear in Chapter 1.

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contents

chapter one

on understanding research publications

Today, research on human behavior is of interest to individuals in a large number of diverse fields. The undergraduate may want to read psychology or anthropology research reports before he has had formal training in research methods. The classroom teacher is interested in research that will aid in the improvement of teaching methods. Social workers and public health workers actively seek information that will help them to carry out their jobs more effectively. Research on mental health problems is of use to psychiatric technicians and nurses as well as psychotherapists and physicians.

Similarly, individuals with formal research training may seek information from other disciplines. The anthropologist may want to know whether or not phenomena he has noted in certain cultures have been studied using experimental methods. The political scientist with knowledge of survey techniques may wish to understand conclusions based on experimental studies of social movements.

While such information is readily available in professional journals and books, it may be quite difficult to understand the manner in which the information is reported. Experiments require controls and measurement, and the results of experimental studies are usually reported in terms of inferences based on statistical calculations.

Although the social scientists' professional colleagues may benefit from the publication of new insights into human behavior and social movements, the professional in related fields who is concerned with applying the results of experimental and survey findings to his own professional field is often left out in the cold. The political scientist who sees the relevance of survey material to his field is faced with the problem of learning an exhaustive amount about survey design and sampling techniques in order to understand the material as it

is usually reported. The nursery school teacher, the pediatric public health worker, or the nurse interested in research in child development soon finds that much potentially interesting and useful information is presented in terms of a complex experimental design, hedged about with statistics of a complexity not even hinted at in an introductory statistics course.

The individual whose experience with statistics is nonexistent, or whose knowledge is limited to an introductory course taken some years ago, frequently finds the statistical presentation of research findings to be beyond his understanding and gives up in disgust or apathy. He may well conclude that the information would be of use to him, but that he has neither the time nor the inclination to acquire the skills that would allow him to understand technical research material.

An intermediate level of proficiency *is* possible, however. Very few individuals could design and build an internal combustion engine, a radio, or an electrical appliance. However, most individuals do know how to use these devices, and with some study could develop a reasonable grasp of the theoretical principles underlying their operation. Similarly, it is possible to understand the logic of statistics and experimental design without being able to carry out calculations or to design experiments.

Before beginning this book, you should be clear on what may be accomplished by studying it. This book is *not* written for the individual who wishes to learn how to design and carry out research. Numerous texts for this purpose already exist.[1] In addition to studying texts, one can best learn to do research by engaging in an active apprenticeship with qualified research workers and by carrying out research work and submitting it for the commentary and criticism of others.

This book will attempt to provide you with the knowledge necessary to become an intelligent and critical reader of research in the social and behavioral sciences. Hopefully, after finishing it you will be able to read much of the research literature in the social and behavioral sciences with some understanding of what is being communicated in the technical shorthand that social scientists use to describe experiments. You will not know much more about how to calculate statistics than you did before you began, and it is doubtful that you will have any great skill in designing experiments as a result of the discussions presented here. However, you should know more about how to interpret statistics as they are presented in the majority of social science publications and should understand the principles an experimenter or a survey research worker adheres to in designing his studies. This will allow you, within limits, to reach an independent decision concerning the validity of the statements made by a research worker about the meaning of his findings.

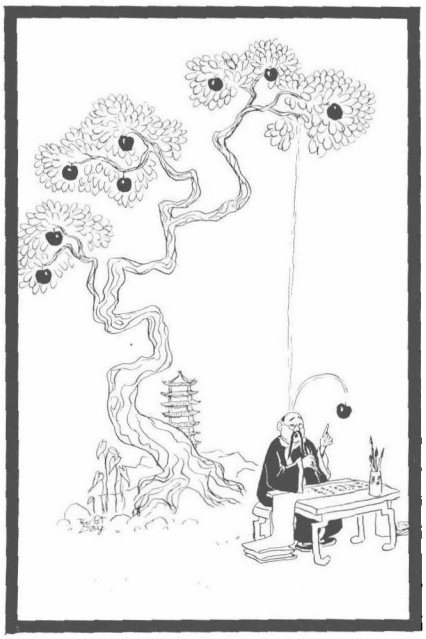
Reading this book will not enable you to understand every variety of research report you may encounter. The number and variety of statistical techniques is constantly increasing, and a comprehensive account, particularly at a beginning level, is an impossible task. We have chosen to limit our presentation to the logic underlying the most commonly used methods in the social sciences.

Undoubtedly some teachers of research methods will object to our approach as being oversimplified and will argue that we are ignoring many aspects they find to be important. Our opinion is that individuals not intend-

ing to do research are much better off with a good overview of the basic principles applicable to understanding a variety of research as reported than with detailed knowledge of statistical models or calculation methods. The effect of social sciences research on our society is potentially as far-reaching as that of any discoveries in the physical sciences, and much of this effect will be brought about by individuals who attempt to apply the results of research to problems plaguing society. Our social progress will be much more satisfactory if these individuals are prepared to critically understand social science research.

FOOTNOTES

[1]In our opinion, one of the best of many such texts is *Foundations of Behavioral Research* (2nd ed.), by F. N. Kerlinger. (New York, Holt, Rinehart & Winston, 1973.)



chapter two

evaluating an experiment: a first example

"Apple fall thirty-two feet per second per second." Drawing by Robt. Day. © 1973 The New Yorker Magazine, Inc.

Perhaps the simplest definition of an experiment is that it is a question asked under controlled conditions. In an experiment you have a set of conditions that enable the researcher to discover the effects of some change he has introduced on a particular phenomenon. The object is to try and specify a cause and effect relationship as precisely as possible under a known set of conditions.

As an illustration, look at the converse situation—an inquiry under everyday, uncontrolled circumstances. Townsend, in his book on research methods,[1] illustrates this point with the example of a man being killed in an automobile accident. Inquiry after the accident reveals the following facts:

1. The accident happened on a night when it was raining heavily.
2. The driver of the car had been drinking heavily for some hours prior to the accident.
3. The driver of the car had been arguing with his wife and appeared to observers to be in a towering rage.
4. The automobile was in poor mechanical condition, with tires that were worn smooth and faulty brakes.

What was the cause of this accident? The inclement weather? Impaired judgment and reactions due to alcohol? Extreme emotional tension affecting judgments? The faulty mechanical condition of the automobile? Clearly, under the existing circumstances, it is impossible to specify one cause of the accident.

This somewhat gruesome example illustrates the conditions that are to be avoided in an experiment. Ideally in an experiment, all the conditions are known and are under the control of the experimenter, so that a definite cause and effect relationship can be established. Although this state of affairs is difficult to attain, especially in studying human behavior, it still represents an

ideal standard for performing an experiment, even though it may not be the only or the best way to understand complex behavior.

Before proceeding, a few terms that are commonly used in discussions of experiments should be explained. We have already mentioned *controls* in our opening discussion. Controls in an experiment refer to those precautions an experimenter takes to insure that conditions that may affect his results are minimized. For example, someone interested in the effects of a particular drug on the learning ability of animals might collect three dogs, four cats, five white rats, and a duck, all of unknown age, background, and health, and set about to determine whether injecting them with the drug improves their ability to learn. The results obtained could not be taken very seriously. Under such circumstances, nothing could be concluded, except perhaps that the research worker did not understand how to do experiments.

Assuming that such factors as age, prior experience, health, species, amount of the drug, diet, and the task to be learned all have potential effects on the subject under study, an experimenter should take the following precautions to control for these factors:

1. Select animals of a given species.
2. Select animals that vary as little as possible in age and that have been raised under known conditions of health and diet and have not been used in any other experiment.
3. Select a learning task appropriate to the animals' capacities.
4. Carry out preliminary tests to determine the amount of the drug to administer or, even better, use several groups of animals, giving each group a different amount of the drug.
5. Assign the animals to the various groups to be studied on a completely chance basis so that any animal may be put in any group. (This is known as *random assignment* and will be discussed in more detail in later chapters.)
6. One group of animals should be given no drug but should be subjected to exactly the same procedures as the animals in the group given the drugs. For example, if the drug is injected into the animals by means of a hypodermic, the group of animals given no drug should also receive injections of some substance known to have no effect, for example, distilled water. Such a group is known as a *control group*, and its purpose is simply to control for the effects of the experimental procedure itself.

In the terminology used in experimental design, the administering of the drug is known as the *experimental treatment*; if several different amounts of a drug are given to different groups of animals, it is known as *levels of experimental treatment*. The group actually given the experimental treatment is known as the *experimental group*. If there are several *levels of experimental treatment*, there will be several *experimental groups*.

Three other concepts need to be introduced and defined before proceeding:

1. Variables (dependent, independent, and extraneous)
2. Hypothesis
3. Experimental validity (internal and external)

In experimental terminology, *variables* refer to the attributes under study, specifically, those qualities that may show change as a result of the experimental treatment. In the example given earlier of the effects of drugs on

learning, the primary variables are the drug and the learning. The drug is known as the *independent* variable. In an experiment, the independent variable (here, the amount of the drug) is what is varied by the experimenter. The effect (the amount learned by the animal), however measured, is known as the *dependent* variable. *Extraneous* variables are those which might affect the determination of the relationship between the drug and the measurement of learning. Some extraneous variables, such as age, health, and prior experiences, were mentioned earlier when the concept of control was introduced. In a well-designed experiment, control of extraneous variables is at a maximum, allowing as precise a specification of the relationship between independent and dependent variables as possible.

A *hypothesis* is a prediction of what will happen in an experiment and how the results will come out. For example, the experimenter doing the drug study may hypothesize that animals given the experimental drug will learn a given task in fewer trials, or require less time than the control animals. An additional hypothesis could be that the speed of learning will continue to increase as larger amounts of the drug are given, up to some amount above which there is no increase in learning speed.

There is a wide range within which the term "hypothesis" is useable. A hypothesis may be no more than the experimenter's best guess as to what will happen, especially if the area under study is a new field of inquiry, or it may represent a carefully reasoned and elaborately specified prediction based on a long series of previous experiments and a detailed theory. However, regardless of what it represents in terms of precision, a hypothesis is what is tested in an experiment.

Experimental validity refers to the meaningfulness of the experiment. To ask the extent to which an experiment has *internal validity* is to ask whether the results—the effects of the experimental treatment—are due to the treatment rather than to some extraneous variables. For example, if you are puzzled by the results of an experiment, it is perfectly appropriate to entertain questions about the meaningfulness of the experimental treatment and procedure. In other words, does it seem reasonable to you that (1) the experimenter's treatments resulted in the difference he found and (2) that this difference occurred for the reasons he claims? If not, perhaps other factors of which the experimenter was unaware may have affected his results. In most instances it would be necessary to repeat the experiment to find out if you were right, but such speculations and doubts on your part are perfectly appropriate, as is your right to suggest other hypotheses which might explain the experimental findings.

The *external validity* of an experiment refers to whether the findings can be generalized beyond a specific experimental situation. For example, in an experiment it might be found that the sexes differ on the dependent variable as a result of the experimental treatment. As an illustration, suppose that a medical research group found that a drug developed to reduce high blood pressure was more effective on the women studied than on the men. Does this suggest a general sex difference in the area of study? Or is the result such that it has no meaning outside the specific group being studied? If you were to read an experiment carried out on mental hospital patients in which the experimenter discusses his findings as though they applied to all mankind, you

might justifiably raise the question of external validity. While the experimental findings may be true for the group studied, their validity when applied to all people must be established by further experimentation.

As the next step in learning to evaluate experiments, you are asked to read the following research report. Reprinted as originally published in *Child Development* in 1967 it was selected because (1) it is on a topic of general interest to almost everyone, (2) the presentation is reasonably straightforward, and (3) some knowledge of experimental design and statistical methods is necessary to fully understand the article. Interpretive comments explaining the general format as well as specific points of the report are inserted throughout. The article and our accompanying commentary are intended to serve as an introduction to some of the problems you will face in seeking to understand social sciences research. The comments are necessarily brief, and most of the items commented on will be discussed in more detail in the chapters to follow.

Perhaps one word of caution should be added. This research report is fairly straightforward and clearly written. You may not always be so fortunate in other studies you may encounter. Many published accounts of experiments require considerable background reading if one is to understand the conceptual basis of the research. This preparation may be necessary to understand the relationship of the original questions posed, the experimental manipulations used, and the final inference drawn from the obtained results. Also, if a research report is turgid, obscure, excessively pedantic, or presented in an idiosyncratic fashion, no book can help you to follow it. You will have to decide for yourself whether the material communicated is worth the effort required to dig it out.

Evaluative Responses of Preschool Children

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The abstract concepts good and bad are loaded with evaluative meaning. Evaluation is important as an ingredient of attitude learning, and the child's understanding of good and bad is also significant in early personality development. 50 children, aged 2–6 were shown 12 sets of multiple-choice pictures. Each set of 4 alternatives contained 1 good activity, or 1 bad activity, or all neutral activities. The growth in the ability of the child to select the loaded pictures is a regular curve starting at chance near age 2 and approaching

The cooperation of Mrs. Marian Fedri and Mrs. Shirley Brooks of the March Air Force Children's Nursery is gratefully acknowledged. This research received partial support from an intramural grant from the University of California, Riverside. Author Rhine's address: Psychology Department, University of California, Riverside, California 92502.

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