

Preface

To prepare a volume describing important applications of statistics and probability in many fields of endeavor—this was the project that the American Statistical Association and the National Council of Teachers of Mathematics (ASA-NCTM) Committee invited me to help with in early 1969. It was the Committee's view that more statistics and its background in probability would be desirable in the school curriculum; thus it would be desirable to show how broadly these tools are applied. The Committee planned this book primarily for readers without special knowledge of statistics, probability, or mathematics. This audience includes especially parents of schoolchildren, school superintendents, principals, and board members, but also teachers of mathematics and their supervisors, and, finally, young people themselves. *Statistics: A Guide to the Unknown* is the result. During the time of the book's preparation several of us who were working on it and teaching simultaneously found much of the material very useful—even inspirational—to undergraduate and graduate students. Unexpectedly, the book had an additional function as an auxiliary text book, and it has frequently been used in that way.

Instead of teaching technical methods, the essays illustrate past accomplishments and current uses of statistics and probability. In choosing the actual essay to include, the Committee and I aimed at illustrating a wide variety of field of application, but we did not attempt the impossible task of covering all possible uses. Even in the fields included, attempts at complete coverage have been deliberately avoided. We discouraged authors from writing essays that could be entitled "All Uses of Statistics in . . ." Rather, we asked authors to stress one or a very few important problems within their field of application and to explain how statistics and probability help to solve them and why the solutions are useful to the nation, to science, or to the people who originally posed the problem. In the past, for those who were unable to cope with very technical material, such essays had been hard to find.

To us, this spread of applications has renewed our appreciation of the unity in diversity that is statistics. On the one hand, we found the same, or similar

statistical techniques being applied to unrelated fields. Authors describe the use of correlation and regression in contexts as diverse as a study of the sun, the fair grading of tests, the effects of taxation on cigarette smoking, and an investigation of the effects of a crackdown on speeders. Other authors deal with applications of sampling theory in such disparate fields as accounting, improving the U.S. Census, and estimating the size of whale populations. And essay after essay discusses experimental design and the necessity, as well as the difficulty, of making inferences from less-than-perfect data. Certainly this unity in diversity helps to demonstrate to the general public the wide usefulness of statistical tools.

On the other hand, we found the essays could be grouped into unities of subject matter with differing statistical techniques. For example, two otherwise unlike essays deal with creating customer satisfaction with a manufactured product. At least five essays describe very different methods of studying diseases, their causes, and cures—the testing of the value of the Salk vaccine, an explanation of the uses of twins in research on illness, the use of randomization to study the effects of innovations in hospitals, a study of the possible deleterious effects of an anesthetic, and a study of health insurance and the effects of decreasing expenditures on health outcomes.

Once the essays had been assembled and edited, we had to decide on their order. Several orderings seemed feasible: We might group the essays by type of statistical tools employed, thus stressing the unity of statistical tools and ignoring the diversity of usual disciplinary lines; we might group the essays by the method used for collecting data—sample survey, experiment, Census material, and so on; or we might group them by the subject matter of the application.

What we have chosen is the last of these modes of organization. We have classified the essays into four broad areas by field of application, with subdivisions within some. Each subdivision is small enough, cohesive enough, and digestible enough to be read as a single unit and to give an overview of applications within a narrow field. But we were unwilling to forgo the advantages of the other possible methods of classification; following the main table of contents, therefore, are two alternate tables of contents, the first organized by the method of collecting the data and the second by statistical tools. In the latter listing, an essay has been listed under a heading whenever the author used that tool, or whenever we felt the reader might learn something about the technique by looking at the essay, or both.

These efforts at classifying emphasized, for us, an aspect of the book we had not deliberately planned or even been aware of earlier. It turned out that we had a large group of essays dealing with public policy, many of them classified under our main grouping entitled "Our Social World." We also found that several essays in this group deal with the evaluation of reforms or changes in policy. On the one hand, we found ourselves with descriptions of two large-scale field experiments: the health insurance experiment and the Salk vaccine trials. It seems that in the United States until recently, we have done few of these controlled experiments, and it appears to the Committee that one of the

jobs that statisticians have been somewhat neglecting is explaining to the public the possibilities and values of experimentation. The public needs such explanations to have a sound basis for deciding whether it wants such experimentation to be carried out. On the other hand, several articles deal with nonexperimental (or quasi-experimental) evaluations of reforms: Did the Connecticut crackdown on speeding decrease traffic accidents? Is a particular anesthetic dangerous? Is a hiring policy discriminatory? Does increased taxation deter teenagers from smoking?

We hope that both types of essays will contribute to a greater appreciation of how hard it is to find out whether a program is accomplishing its purposes. Such understanding would give people a little more sympathy for government officials who are trying to do difficult jobs under severe handicaps. It may also, as pointed out above, encourage them to press government to do better-controlled field studies both in advance of and while instituting social reforms.

There is an old saw that a camel is a horse put together by a committee. Our authors supplied exceedingly well formed and attractive anatomical parts, but to the extent that this book gaits well, credit is due primarily to a most talented and dedicated Committee. In general, the approach to unanimity in the Committee members' critical review of and suggestions about the essays was phenomenal. And, though they may occasionally have been divided about the strong and weak points of a particular essay, they were constantly united in their purpose of producing a useful book and in their ability to find something more than 24 hours a day to work on it. This dedication, together with my own compulsiveness, has undoubtedly created difficulties for our authors. Nevertheless, our authors persevered and deserve enormous thanks from me, from the Committee, and from the statistical profession at large.

A work of art or literature may be ageless—a work of science is not. It has been 16 years since the first edition of *Statistics: A Guide to the Unknown* (SAGTU) appeared, and 10 years since the second edition. Much has happened in the world of statistics in that time, and there have been major efforts to introduce statistics to the general public via books and even television programs. Indeed, I have recently written a preface for a Chinese SAGTU edition. So we felt it was time for a new and leaner edition of SAGTU.

The second edition expanded the first by adding two new essays and by appending study materials to the essays. The third edition represents a major change. Authors have updated the essays that have been carried over from the earlier editions, and the book contains a dozen new essays. All of the essays continue to have study material.

Our thanks go to the Sloan Foundation whose grant made it possible to put the first edition together.

For the first edition there are others to thank as well: for the hard work and advice of George E. P. Box, Leo Breiman, Churchill Eisenhart, Thomas Henson, J. W. Tukey, and the late W. J. Youden; to the office of the American Statistical Association (and, in particular, to Edgar Bisgyer and John Lehman) for invaluable help in all the administrative work necessary to get out a book such as this; and similar thanks to the administration of the National Council of Teachers

of Mathematics; to Edward Millman for careful and imaginative editorial assistance; and to other people at Holden-Day, especially Frederick H. Murphy, Walter Sears, and Erich Lehmann, our series editor; to Mrs. Holly Grano for acting as a long-distance and long-haul secretary; and to the many friends and colleagues both of the editor and of the Committee members who so often acted as unsung, but indispensable advisors.

As time has passed we continue to feel gratitude to all these people, especially to Frederick Murphy at Holden-Day who continued to watch over SAGTU for many years. The supplementary study material for the essays in the second edition was the invaluable contribution of David Lane, Donna and Leland Neuberg, Rick Persons, Haiganoush Preisler, and Esther Sid. It would have been impossible to produce this third edition without the invaluable assistance of Marjorie Olson. Betty Pond also deserves my thanks for taking care of many details, and we are most grateful for the assistance of John Kimmel of Wadsworth and Linda Loba of Brooks/Cole in the production process. But, once again, our greatest thanks go to the authors of the essays, who produced fine manuscripts under severe time pressures and were patient and responsive in the face of our constant requests for revisions.

It is my hope, and the hope of all of the editorial board, that SAGTU will continue to be useful as a supplementary text and will continue to do missionary work encouraging the inclusion of statistics and probability in curricula.

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