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PREFACE

To PREPARE a volume describing important applications of statistics and probability in many fields of endeavor—this was the project that the 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 included especially parents of school children, 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. It would seem that, quite unexpectedly, the book has an additional possible function as an auxiliary textbook.

Instead of teaching technical methods, the essays illustrate past accomplishments and current uses of statistics and probability. In choosing the actual essays to include, the Committee and I aimed at illustrating a wide variety of fields 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 have 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 have been hard to find.

To us, this spread of applications gives a renewed appreciation of the unity in diversity that is statistics. On the one hand, we found the same, or similar, statistical techniques being applied in unrelated fields. Authors described the use of correlational analysis in contexts as diverse as a study of the sun, a test of the relative importance of economic variables, an exploration of the components of leadership in the military, and an examination of the effect of registration regulations on voting turnout. Other authors dealt with applications of sampling theory in such disparate fields as accounting, improving the U.S. Census, and opinion polling. 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 is unity in diversity that will help to demonstrate to the general public the wide usefulness of statistical tools.

On the other hand, we found essays grouping themselves into unities of subject matter with differing statistical techniques. For example, two otherwise unlike essays deal with the evaluation of the effectiveness of innovations in traffic control procedures in reducing accidents. At least four essays describe very different methods of studying diseases, their causes and cures—the testing of the value of the Salk vaccine, a mathematical model for disease epidemics, a history of the study of the association between smoking and ill health, and an explanation of the uses of twins in research on illness.

We have tried to emphasize these unities and at the same time avoid unnecessary repetition by a system of cross-referencing. Thus, whenever another essay contains material that will assist the reader to understand the present essay or give him further insight into a particular problem, he is directed to it.

Once our 44 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 essays by the method used for collecting data—sample survey, experiment, Census material, and so on; or we might group them by subject matter of the application.

What we have chosen is the last of these modes of organization. We have classified into four broad areas by field of application, with subdivisions within each. 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 method of collecting the data, 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 "Man in His Social World." We also found that several of 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 speed-limit experiments in Scandinavia and the Salk vaccine trials. It seems that in the U.S., 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 deal with nonexperimental (or quasi-experimental) evaluations of reforms: Did the Connecticut crackdown on speeding decrease traffic accidents? Did the assignment of more patrolmen to a New York City precinct decrease crime? Is a particular anesthetic dangerous?

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's critical reviews of and suggestions about essays was phenomenal. And, though they may have occasionally 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.

Our thanks go also to the Sloan Foundation whose grant made it possible to put this book together.

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 indispensible, advisors.

Judith M. Tanur

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