

## BOOK REVIEW

Bryan F. J. Manly, *The Design and Analysis of Research Studies*, Cambridge University Press, Cambridge, United Kingdom, 1992, 353 pp., \$37.95.

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Manly has written this concise text for workers in the biological and social sciences who have mastered the material presented in introductory statistics courses and are interested in honing those analytical skills that will be most useful in empirical research. To this end, Manly has eschewed in-depth treatments of much of the material found in standard statistical textbooks for a more wide-ranging discussion of analytical approaches and experimental designs, with a focus on helping workers avoid common pitfalls in quantitative research. The text covers sampling techniques, the linear regression model (which is used as the platform statistical model for many of the subsequent analyses presented in the book), the basics of experimental design, analysis of variance models, time series analysis, analysis of count and proportion data, and randomization tests and other computer-intensive statistics. The text concludes with discussions of ethics in research and an overview of recommended steps for conducting a research study, beginning with the clear exposition of specific questions to be addressed and ending with the preparation of a written research report. Most chapters are concluded with a brief set of exercises, and the text is liberally enriched with examples and more detailed case studies.

To provide an overview of statistical analyses that was broad in scope and yet sufficiently concise and engaging to be read cover to cover, Manly had to make some compromises. First, the theoretical underpinnings of most of the analytical procedures treated in the book are not derived from first principles; this reduces the didactic value of the work as a statistics text and in places renders the discussion somewhat superficial. Second, the book is not comprehensive in any sense and clearly is not intended to act as a reference. For example, nonparametric analyses are not covered. Having made these compromises, however, the result is a cohesive treatment of a wide variety of analytical tools and the perspective of how and when each may be most gainfully applied in research. Many approaches that often are not treated in graduate-level introductory statistics courses are introduced, and throughout the text current references are provided to more in-depth treatments of topics. Readers will almost certainly want to consult one of these more advanced references before using a particular analysis in their own research. Chapter 8, which focuses on analysis of non-normal data, is

particularly lucid and valuable. Options for non-normal data are discussed in the broadest sense, and a variety of techniques are presented in more detail, including regression modeling with log-linear and logistic models. Here and throughout the text the use of dummy variables to code categorical variables in regression models is clearly explained and demonstrated. The examples presented and a final case study make the presentation easily accessible. Chapter 9 introduces computer-intensive statistics and clearly demonstrates the versatility and power of randomization and Monte Carlo methods. These treatments should provide most readers with an expanded range of analytical tools with which to approach their data.

Aspects of experimental design covered include sampling techniques, designs to assess the effect of a single treatment compared to a single control group, and more complex designs, including factorial, Latin squares, nested factors, split-plot, and repeated measures. Censusing techniques for sampling the positions of objects in space are particularly well described. Common threats to internal and external validity of experiments are discussed, and other sorts of pitfalls are described, including pseudoreplication, confounding variables, and inadequate controls. In these discussions of experimental design and in the concluding chapter, which presents an overview of the stages of carrying out a research study, Manly provides experienced perspectives on a wide range of topics pertinent to conducting sound science.

Throughout, the writing is light and lucid; the diversity of the examples and case studies (the best of which are presented with the full raw data set) make it an enjoyable read. The book will be most useful to neophyte researchers if they read the entire book, as its most valuable contribution will be in providing perspective in statistical analysis, a subject in which students often cannot see the forest for the trees. More seasoned researchers should also find it a valuable review and introduction to novel analytical approaches that are finding increasing use in biological and social science research.

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