

meaning of the word, autobiographical.—W. L. Williamson, *Library School, University of Wisconsin—Madison.*

Cleveland, William S. *The Elements of Graphing Data.* Monterey, Calif.: Wadsworth Advanced Books and Software, 1985. 323p. \$18.95 LC 85-10603. ISBN 0-5340-3730-5.

The only negative thing that might be said in connection with this book is that it probably won't be read by even a fraction of the scholars who could benefit significantly from exposure to its content. Cleveland's insights and principles go far beyond the relativity simple problem of creating legible graphics; as he writes in the preface: "This book . . . contains graphical methods and principles that are powerful tools for *showing the structure of data*" (p.1, my italics).

Like maps (with which I am most familiar), graphs are made for two quite different reasons. The first is data analysis, for which the scholar uses the graph to tease out or make explicit relationships among observations for his own benefit. The second is data communication, for which the scholar-analyst has determined what the structure of the data is and wants to communicate it effectively to others. Thus a graph can be both an intermediate working tool and a final product, uniquely efficient for both, superior in many instances to words, numbers, or (even) maps. But in the formal educational curriculum at all levels (including college and graduate school) there is an almost overwhelming bias in favor of acquiring and conveying meaningful relationships among data in verbal or numerical form. Cleveland's book forces one to realize what a serious loss this is for scholarship, even for our culture as a whole.

The Elements of Graphing Data is to graphs what Strunk and White's *The Elements of Style* is to text; high praise is implied and intended in this parallel. Cleveland's writing style—clear, concise, orderly, authoritative, and commonsensical—suggests that he has more than a passing acquaintance with Strunk and White's classic volume. The publisher has also done well by Cleveland, with attrac-

tive, legible type, and a generally well thought out book design.

As to content, the book contains four major sections. The first is a brief introductory discussion about graphs, with an emphasis not so much on their form per se (although he integrates knowledgeably the subject of visual perception with all aspects of graphs) as on the meaning that data can take on in graphed form. Cleveland, a scientist at AT&T Bell Laboratories, has been studying (and inventing) graphical methods for data analysis and presentation for more than ten years.

The second section is a how-to gem, "Principles of Graph Construction." It should be required reading for all educated human beings.

The third section deals with graphical methods and moves at times quite deeply into the domain of statistics. The nonspecialist can easily browse through this section, taking as much as seems useful.

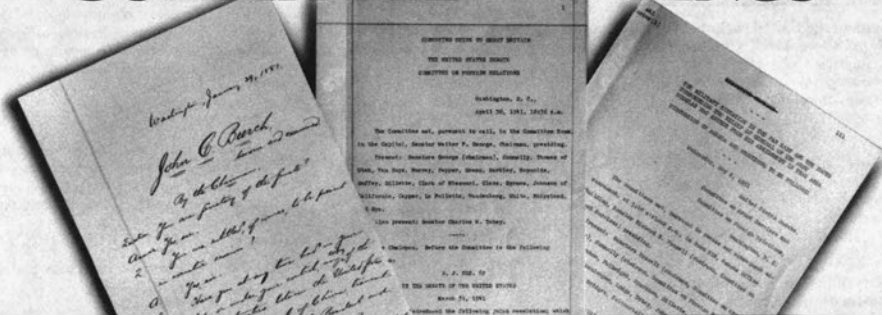
Throughout the book Cleveland uses real data sets to illustrate copiously his discussion. This has the effect of making the book a fascinating read because he delves into actual scientific questions, e.g., do hamsters who hibernate more live longer? In one case study, Cleveland reviews the complete 1980 volume of *Science*; the majority of articles (67 percent) contained graphs, almost four hundred in number. Nearly one-half of these graphs were flawed, one-third seriously so (something on the graph was not explained, for example). Cleveland's own illustrations (computer generated) are numerous and clear.

The book closes with an admirable exposition of the principles of graphic perception and cognition that bear on the construction and comprehension of graphs. In some respects it might have been logical and useful for the book to begin with this material, but it probably does take on additional meaning after one has thought intently about graphs for more than two hundred pages.

This book is a gem. Buy it, read it, and urge everyone you know whose job it is to convert raw data to meaningful information to do the same.—Barbara Bartz Petchenik, *Cartographic Services, R. R. Donnelley & Sons, Chicago, Illinois.*

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