

This article was downloaded by:

On: 14 January 2011

Access details: *Access Details: Free Access*

Publisher *Taylor & Francis*

Informa Ltd Registered in England and Wales Registered Number: 1072954 Registered office: Mortimer House, 37-41 Mortimer Street, London W1T 3JH, UK



Molecular Simulation

Publication details, including instructions for authors and subscription information:

<http://www.informaworld.com/smpp/title~content=t713644482>

A review of: “THE ELEMENTS OF GRAPHING DATA, by William S. Cleveland. Wadsworth Advanced Books and Software, Monterey, California 93940; 1985. ISBN 0-534-03729-1 (cloth). ISBN 0-534-03730-5 (paper). 323 pages.”

J. M. Haile

To cite this Article Haile, J. M.(1988) 'A review of: “THE ELEMENTS OF GRAPHING DATA, by William S. Cleveland. Wadsworth Advanced Books and Software, Monterey, California 93940; 1985. ISBN 0-534-03729-1 (cloth). ISBN 0-534-03730-5 (paper). 323 pages.”', *Molecular Simulation*, 1: 4, 271 — 273

To link to this Article: DOI: 10.1080/08927028808080948

URL: <http://dx.doi.org/10.1080/08927028808080948>

PLEASE SCROLL DOWN FOR ARTICLE

Full terms and conditions of use: <http://www.informaworld.com/terms-and-conditions-of-access.pdf>

This article may be used for research, teaching and private study purposes. Any substantial or systematic reproduction, re-distribution, re-selling, loan or sub-licensing, systematic supply or distribution in any form to anyone is expressly forbidden.

The publisher does not give any warranty express or implied or make any representation that the contents will be complete or accurate or up to date. The accuracy of any instructions, formulae and drug doses should be independently verified with primary sources. The publisher shall not be liable for any loss, actions, claims, proceedings, demand or costs or damages whatsoever or howsoever caused arising directly or indirectly in connection with or arising out of the use of this material.

Book Review

THE ELEMENTS OF GRAPHING DATA, by William S. Cleveland. Wadsworth Advanced Books and Software, Monterey, California 93940; 1985. ISBN 0-534-03729-1 (cloth), ISBN 0-534-03730-5 (paper). 323 pages.

A few years ago Edward R. Tufte published a beautiful and ground-breaking book, *The Visual Display of Quantitative Information* (Graphics Press, Box 430, Cheshire, Connecticut 06410), revealing many of the features that distinguish good from bad design in data graphics. The book drew most of its examples from business and the media and, while all of the Tufte's identifications of good principles are sound, their extremes are not always realistic when applied to scientific writing. For example, Tufte recommends the elimination of figure numbers from all graphics: if a graphic is referred to in different parts of the text, he would reproduce the graphic instead of referring back via a figure number.

In *The Elements of Graphing Data*, William S. Cleveland has corrected this situation and has also performed a valuable service for the scientific and engineering communities. A major strength of the presentation is the repeated use of graphics taken from the published scientific literature. If the example is weak, Cleveland shows why it fails and offers an improved version. If the example is good, he discusses why it succeeds. The examples were obviously chosen with care, for not only do they reinforce the points Cleveland wishes to make, but in the successful forms (the originals or the author's versions) they convey nuggets of interesting information.

The book is divided into four chapters: Introduction, Principles, Methods, and Perception. The second chapter, Principles of Graph Construction, emphasizes the usual criteria for effective communication: clarity and completeness. Most of the principles are common sense, but again they are illustrated by compelling examples. In light of the frequency with which these sensible rules are violated, it is valuable to have them collected in one place.

Two points discussed in Chapter 2 are particularly important. One is that, just as good writing comes about by revising and editing, so too must good graphics. An effective graphical display does not occur either accidentally or spontaneously. The second point is the use of multiple panels. Often we need to show several curves or data sets on the same figure, but if they are plotted on the same axes, they obscure one another. The solution is to use separate axes (panels). Usually the panels are aligned vertically but sometimes it is effective to separate them both horizontally and vertically (the scatterplot matrix). This keeps the data sets physically close so the desired comparisons can be made, but prevents the data sets from visually interfering with one another. Chapter 2 should be read by all graduate students in science and engineering and it should be reread annually by all of us who publish in the technical literature.

The chapter on Graphical Methods presents several new methods, but two appeal to me in the sense that I think I will use them. One is log plots, but in base two rather than base ten. Base two logarithms are often more effective than other scales because

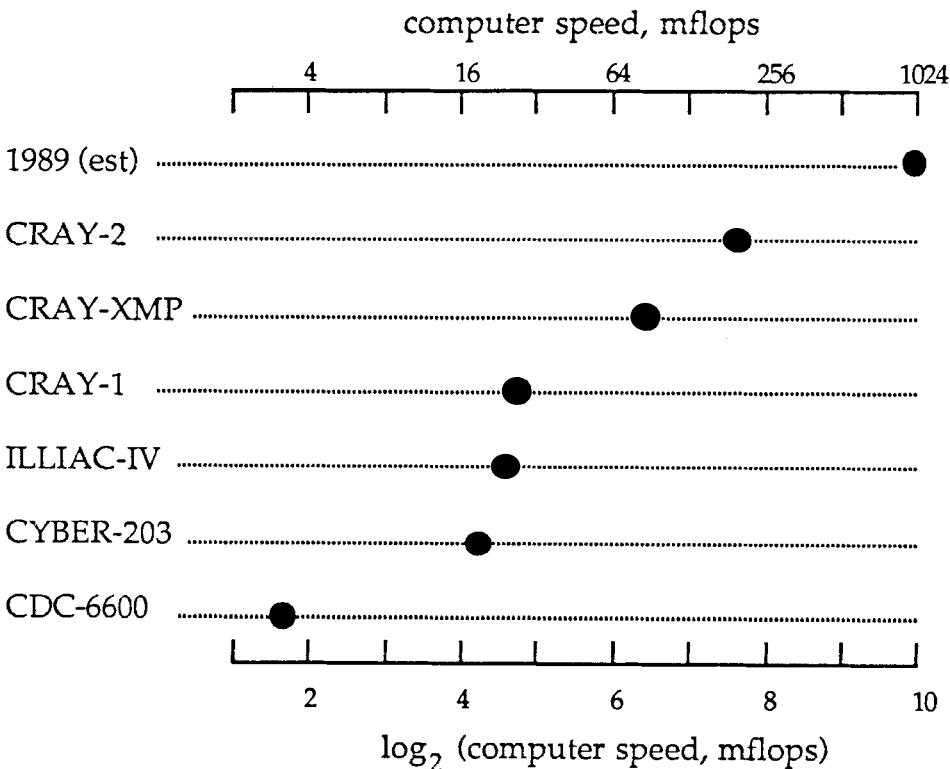


Figure 1 Example of a dot chart. Approximate execution speed of several digital computers (mflops = one million floating point operations per second). Adapted from S. Karin and N.P. Smith, *The Supercomputer Era*, p. 222, which in turn was taken from V.L. Peterson and J.G. Arnold of NASA's Ames Research Center.

they (a) compress the range of the data to fit on the page, (b) separate individual data points, and simultaneously (c) maintain a readily interpreted scale (each tic on the corresponding linear scale is double the previous tic; see Figure 1). The second new idea I like is the dot chart, which is useful when one of the variables being plotted has only an identifying label rather than a numerical value, as in the figure. Other new ideas include ways to deal effectively with distributions, time series, and residuals. Also included is a valuable scheme for presenting overlapping data points.

The final chapter considers the psychology of graphical perception: how a reader attempts to decode the messages presented in graphical form. Cleveland discusses the difficulties readers have in correctly judging slopes, angles and areas. This is the weakest chapter of the book, primarily because it is rather tentative. As more psychological studies of graphical perception are performed, this chapter will undoubtedly be strengthened in later editions. The use of color is mentioned here, but not dealt with in any detail. This topic needs more attention because of the increasing availability of color CRTs and color printers. Thus, normal human vision has difficulty in resolving red objects superimposed on a black background, yet at

technical meetings one is routinely confronted with slides on which red data points or curves overlay a dark background.

Overall, *The Elements of Graphing Data* is a fine addition to the technical literature and well worth studying.

J. M. HAILE