Statistical Science
1987, Vol. 2, No. 4, 353–354

In This Issue

Computer graphics have become a standard tool of statistical methodology, both in the analysis of data and in the presentation of the results of that analysis. In their excellent article in this issue, Richard A, Becker, William S. Cleveland and Allan R. Wilks review dynamic graphical methods for data analysis in which "The data analyst takes an action through manual manipulation of an input device and something happens, virtually instantaneously, on a computer graphics screen." They describe a wide variety of dynamic methods and systems currently in use or under development that promise to be of value in the design of effective new techniques. Their claim for the importance of their topic is simply stated: "In the future, dynamic graphical methods will be ubiquitous."

In preparing their article, Becker, Cleveland and Wilks faced an overwhelming obstacle: how to describe and illustrate dynamic graphics in a publication that is by its very nature a static medium. They suggested two very different ways of overcoming this obstacle, one making use of modern technology and the other making use of an extremely primitive dynamic method. The first suggestion was that they prepare a videotape that could either be circulated with this issue or be obtained by interested readers from the Institute of Mathematical Statistics. When this suggestion was turned down, they suggested that a small picture might be printed in the upper corner of each page of this issue so that when the pages were riffled quickly, the viewer got the impression of a moving picture, in the fashion of some of the old books of cartoons that we used to see as children. Alas, with regret, this ingenious suggestion was also turned down. Nevertheless, the authors have succeeded admirably in illustrating their methods in the traditional way of journal articles, through the generous use of carefully chosen figures. We hope you will enjoy both their text and their figures.

The discussants John W. Tukey, Peter J. Huber, William F. Eddy, Howard Wainer and Edward R. Tufte all contribute their views on the subject in their own special styles. Tufte even includes a picture of a Tokyo train schedule as a bonus.

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Some time ago, Mark J. Schervish was presented with review copies of two recently published books—the second edition of T. W. Anderson's classic text, *An Introduction to Multivariate Statistical Analysis*, and William R. Dillon and Matthew Goldstein's *Multivariate Analysis: Methods and Applications*—and was invited by the editors of *Statistical Science* to use the publication of these books as the basis for an overview of the current state of the field of multivariate analysis. We wanted more than an ordinary book review that would discuss the contents of the books critically and place them in perspective by describing where they were located in the multidimensional world of multivariate analysis with respect to their coverages and approaches. We wanted an article that would also recognize that books like these can be and have been influential in affecting the future development of the subject. Professor Schervish has responded with a stimulating survey of the field written from his own distinctive point of view. Most readers will discover helpful overviews of topics with which they may not be very familiar such as cluster analysis, multidimensional scaling, factor analysis and latent classes. In particular, there is a section devoted to path analysis and linear structural relations, models that are not well known to mathematical statisticians, that includes examples of their use and misuse.

The discussants of this article include the authors of the books under review, T. W. Anderson and Matthew Goldstein, as well as Michael D. Perlman, Pranab Kumar Sen, R. Gnanadesikan and J. R. Kettenring and S. James Press, all of whom are themselves well known contributors to multivariate analysis. Many of these discussants offer descriptions of topics not mentioned by Schervish.

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James H. Ware, writing about growth curves in the *Encyclopedia of Statistical Sciences* states that, "Although the study of growth is an important topic in many biological sciences, the term *growth curve* has a special meaning in statistics. Growth curve analysis applies to data consisting of repeated measurements over time of some characteristic, obtained from each member of a group of individuals.... The distributional assumptions must take account of the statistical dependence of repeated measurements on the same individual." In this issue we are pleased to present an article by C. Radhakrishna Rao on growth curves. As Nan Laird and Nick Lange state in their discussion of this article, "One can scarcely think of any problem in growth curve estimation without bringing to mind the extensive contributions of C. R. Rao, which span some thirty years of research in this area." In his present article, Professor Rao focusses on the fundamental problem of predicting future observations for an individual based on past observations for that individual and comparable data from other individuals. The article is written in a largely expository style and emphasizes the striking general finding that much of the information for prediction in growth curve models "is contained in the immediate past few observations or a few summary statistics based on past data."

The article has stimulated an interesting set of comments. In his discussion, David R. Brillinger describes a problem in earthquake engineering that illustrates how "one can handle nonlinear forms and irregular time points in a direct likelihood-based manner." Nan Laird and Nick Lange discuss the use of least squares and empirical Bayes procedures for polynomial growth curve models. David Draper outlines an approach "to make the exchangeability judgments explicit, to capture uncertainty in those judgments and to propagate that uncertainty through to the final predictions and uncertainty assessments." Alan Julian Izenman emphasizes that "context should always play a role in the modeling process." Both he and Draper feel that in Rao's article there is no clear description of the data sets used as examples or why they are interesting for prediction purposes. Hirotugu Akaike stresses that criteria other than that based on the cross-validatory approach can be useful in the selection of a growth curve model. Seymour Geisser describes some of his previous research applying the sample reuse technique to growth curves and emphasizes the value of Bayesian predictive distributions.

Readers who would like to learn more about the accomplishments and views of C. R. Rao are referred to the interview with him that was published in the February 1987 issue of *Statistical Science*.

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In their "Survey of Soviet Work in Reliability," Andrew L. Rukhin and H. K. Hsieh state that many important results in reliability theory have been obtained by Soviet scholars, but that this research is not always familiar in the United States. On the other hand, all major western monographs on reliability theory have been translated into Russian. Their review stresses theoretical work, rather than applications, developed in the Soviet Union during the last two decades.

The discussants of this article include Richard E. Barlow and Zohel S. Khalil, Nozer D. Singpurwalla, Ilya Gertsbakh and Asit P. Basu, all of whom are distinguished researchers in reliability, and Elliot H. Weinberg, Director of the Navy Center for International Science and Technology, who describes the general lack of knowledge in the United States about Soviet scientific and technological research. Two Soviet experts in reliability theory were also invited to contribute to the discussion of this article, but unfortunately neither of them replied.

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The featured interview in this issue is with Albert H. Bowker, who served as the founding chairman of the Department of Statistics at Stanford University and, subsequently, as Chancellor of the City University of New York and Chancellor of the University of California at Berkeley.