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Book and Software Reviews

Books for review are to be sent to the Book Review Editor Jaki Stanley, USDA/NASS, Research Division, Room 305, 3251 Old Lee Highway, Fairfax, VA 22030, U.S.A.

Carl W. Roberts, ed. *Text Analysis for the Social Sciences: Methods for Drawing Statistical Inferences from Texts and Transcripts*. Mahwah, NJ: Lawrence Erlbaum, 1997. ISBN 0-8058-1735-2 (paper). 316pp. + refs and index. 39.95 USD.

Carl W. Roberts, Iowa State University, edited sixteen chapters to introduce individuals to developments in semantic and network textual analysis and to develop ideas for social scientists already familiar with this analysis. The focus is limited to quantitative, statistical analysis of texts and transcripts. Semantic and network text analyses are relational approaches and are contrasted with more traditional, thematic text analysis methods which form the classic content analysis approach. A variety of authors explore three separate parts of textual analysis: methodologies, applications, and prospects for a coherent framework. The central question of this volume is: Which text analysis method(s) best affords answers to what research questions?

Three quantitative text analysis methods structure the methodologies and applications sections. The methods differ according to variables employed; thematic methods make use of concepts, semantic methods use clauses in sentences, and network methods employ a combination of concepts and clauses. Several chapters show possible combinations between two or more forms of text analysis (see Kleinnijenhenhuis et al.). Semantic analysis can be applied to a range of texts from archival sources, from lead sentences in news sources, to textbook chapters. Roberts develops a generic semantic grammar that allows a computer program to encode themes and theme relations. Network text analysis develops a vocabulary (Carley) to show importance of concepts and concept position, and allows logically implied statements from objective analyses. A variety of computer software programs are used to conduct these analyses (Popping, Bechtel). Professionals and practitioners can assess how far researcher's interpretation rules for computer programs have progressed, whether such rules permit a variety of intended meanings, and what database limitations must be recognized (Baker).

The Applications Section focuses on defining the conceptual base of textual analysis and developing methodological approaches to explore data collection and data analysis problems. Several authors offer means to represent language and propose language models. A main research direction is relationships between language and society, including description of social reality, e.g., Danielson and Lorsorsa, and Franzosi. Most authors offer suggestions for additional research and hypothesis testing. Danielson and Lorsorsa reveal major social and political changes in American society through a thematic analysis of 100 years of front page news in the **New York Times** and the **Los Angeles Times**. Franzosi shows how narrative data plays an increasingly important role in social science inquiry. He applies a semantic grammar to understand multiple perspectives concerning ''Labor Unrest in the Italian Service Sector'' during the first half of 1986. Baker, in the Prospects section, provides an excellent demonstration of text analysis through natural language database systems. He shows key elements of building a linguistic data base for conducting text analysis.

Roberts's concluding chapter examines ''A Theoretical Map for Selecting Among Text Analysis Methods.'' This theoretical map shows a methodological outline to draw statistical inferences about populations of texts and to delineate a ''universe of substantive questions that can be addressed via relational and thematic text analysis''. Special attention is given to subject-action-object analysis and connections between interrelated statements into a network. Several authors (especially Carley) indicate how conceptual networks – pair-wise relations – can be extracted from the structure of action connected to societal choices. These choices are embodied in a linguistic social structure. These analyses form the basis for linkages between the three main forms of text analysis; thematic, semantic, and network. Moreover, reliance upon language to characterize the structure of the conceptual network allows analysis along a series of dimensions rather than a single dimension.

Political scientists, survey researchers and statisticians will obtain a good initial overview of text analysis that will allow better understanding of research that employs these methods. Two chapters provide advanced analysis for individuals who have already used or know about these methods. Throughout the volume, arguments are presented in an understandable format. Many authors suggest future research and possible models for analysis. Chapters range from exploratory to finished products and provide a thoughtful and interesting volume about the utility of text analysis in the social sciences.

Steven Puro
Department of Political Science
Saint Louis University
St. Louis, Missouri 63103
U.S.A.
Phone: (314)-977-3037
Fax: (314)-977-1462
e-mail: puro@slu.edu

Susanne P. Lajoie. *Reflections on Statistics: Learning, Teaching, and Assessment in Grades K-12*. Mahwah, New Jersey: Lawrence Erlbaum Associates, Publishers, 1998. ISBN 0-471-18245-1. 316pp. ISBN 0-8058-1972-x. 39.95 USD.

In 1989 the National Council of Teachers of Mathematics released its Curriculum and

Evaluation Standards, a series of recommendations for the teaching of statistics in grades K-12. Little or no research existed on the implementation of these guidelines. Consequently, an interdisciplinary working group created by the National Center for Research in Mathematical Science Education (NCRMSE) has been conducting research to bridge this gap. *Reflections on Statistics* is a group of essays representing some of that work.

Reflections on Statistics is divided into four sections each covering an aspect of statistical education: content, teaching, learning, and assessment. Central to this book is the idea that students need to understand, rather than just do statistics. As may be expected from an edited volume, this book disappoints in terms of the prescriptive detail it provides – in general, there is too much without sufficient context to understand the detail. The volume also provides little in terms of theoretical guidance for researchers seeking to conduct theoretically-grounded empirical research to help this field grow. In shaping a field of study in its infancy, theory development is vital.

Nevertheless, this book does give the reader a taste of this research, and provides a map for finding work in this field. Many of the chapters present promising research, but the reader would do better to read the longer versions of the research. Many will be or have been presented in book form.

Lajoie accurately identifies the audience for this book including groups or individuals such as ''teachers interested in learning about research on statistical problem solving that has been conducted in classrooms,'' and ''mathematics educators interested in the contributions from cognitive scientists regarding how students best learn statistics . . . '' (p. ix). She also mentions cognitive scientists and educational psychologists as well as statistics educators.

Even college level statistics and research methods instructors may benefit from this volume. First, college professors should be aware of the research/statistics experience which students bring to the classroom. Second, the information about how students learn statistics may be valuable to anyone thinking about how to teach statistics and research methods.

The book begins appropriately with an explanation of the broad concepts with which students should be familiar by the time they graduate from high school. Scheaffer et al. (Chapter 1) argue that students should be able to critique data and studies, particularly survey research. In order to do that, a student should develop ''number sense,'' have learned ''study planning, data analysis, probability from a distributional perspective, and statistical inference introduced from an intuitive perspective'' (p. 25).

The second chapter completes the section on statistical content. Burrill and Romberg provide a description of a teaching program used at the middle school level, Mathematics in Context. The program is designed to help students understand the role of statistics in their own lives.

Part II of the book, ''Teaching Statistics'' is comprised of the third and fourth chapters. Bright and Friel (Chapter 3) describe ways in which the results of research may be communicated, namely how students may graph data. The authors note that students simply cannot just be told what methods to use. Teachers need to discuss and compare the different methods of graphing data. They note that one of the biggest problems in statistics education is teachers need to know how to manage this discussion.

This idea lends naturally into Chapter 4, where Friel and Bright discuss the statistics

knowledge level of teachers, probably the core challenge of implementing statistics instruction. They describe the Teach-Stat: A Key to Better Mathematics, a professional development program that was implemented in North Carolina to develop statistical knowledge of elementary school teachers.

The third section of this book is about how students learn statistics. In Chapter 5, Horvath and Lehrer discuss the components of statistics, and how students understand those models. In Chapter 6, ''Emergent Ideas of Chance and Probability in Primary-Grade Children,'' Metz describes the intuitive knowledge which elementary students bring to the classroom.

Continuing the section on learning statistics, Derry et al. (Chapter 7) describe the results of a three-week middle school instructional unit, which brought together science, social studies and mathematics. The object of the unit was to show how statistics are used in a real world situation, such as a legislative hearing. This chapter was perhaps the most interesting to read, and is promising research based in theory.

The final section of the book focuses on assessing statistical performance. Lajoie et al. (Chapter 8) examine the Authentic Statistics project, a computerized method of teaching statistical applications. The computer provided a tutorial of statistics and monitored the students' progress as they designed their own research projects. The analysis was too in-depth and the data too complicated for a chapter-length treatment.

In Chapter 9, Schwartz et al. described the results of three studies examining fifth and sixth grade students' understanding of statistical inference and sampling. The authors make the argument that intuition and knowledge used by students to answer questions may be different based on the context of the situation. Students may have ''competing understandings.'' Therefore statistical instruction should build on intuition and integrate the pieces of knowledge into fuller understanding. The work and research presented in this essay is perhaps the most intuitively appealing and theoretical as any in this volume.

In Chapter 10, Gal describes the challenges educators face as they focus less on the procedures of statistics (generative skills) and more on interpretation and understanding (interpretive skills). He uses examples from the Statistical Reasoning in the Classroom Project (STARC). He argues that teachers need to understand the logic behind student's reasoning and opinions in order to evaluate those opinions. In the process of having students explain their reasoning, students will develop better communication skills.

Lajoie integrates all the chapters into the conclusion. She knows the connection between the book's sections, illustrating that teaching, learning, content and assessment are difficult to separate. She shows the need for theory to connect the pieces, and outlines a future research agenda which includes selection of such a ''theoretical paradigm.'' However, theory development should have been the first step, not the next step in the research.

Martha Kropf
University of Missouri
Department of Political Science
Kansas City, MO 64112
U.S.A.
Fax: (816)-235-5594

G.T. Henry. *Graphing Data: Techniques for Display and Analysis*. Sage Publications, Thousand Oaks, 1995. ISBN 0-8039-5675-4. Vi + 161pp. 16.95 USD.

A. Wallgren, B. Wallgren, R. Persson, U. Jorner, and J. Haaland. *Graphing Statistics & Data*. Sage Publications, Thousand Oaks, 1999. ISBN 0-7619-0599-5. 94pp. 17.95 USD.

Statistical graphics have a long and illustrious history. Tufte (1983) has documented many examples of the early use of graphics to help researchers understand data and convey that understanding to the reader. Yet with the rise of mathematically sophisticated statistical techniques, statistical graphics have become a stepchild, rarely taught in either introductory or advanced classes and neglected in our literature. Too often, academics and researchers fail to use graphics when they could easily replace and enhance the proverbial thousand words, while examples of poor and misleading graphics in the popular press are all too common.

In recent years, however, the art and science of graphing data has shown signs of regaining its former prominence. The landmark publication, of course, is Tufte's 1983 volume *The Visual Display of Quantitative Information.* Tufte followed these works with *Envisioning Information* (1990) and *Visual Explanations* (1997). These works have been incredibly successful – all three were found on the Internet bookseller Amazon.com's list of their ten best-selling books for 1997 – and have brought the author a degree of fame rarely found in statistical circles. Less renowned, but no less valuable, are Cleveland's two volumes, *The Elements of Graphing Data* (1985), and *Visualizing Data* (1993).

None of these works, however, are aimed at student audiences. Nor are they meant as handbooks for the applied researcher, manuals to turn to for help with everyday problems. Now two books have appeared in an effort to fill this void.

Wallgren et al.'s *Graphing Statistical Data*, ostensibly aimed at ''all those who have to illustrate numerical data,'' is best suited for a student audience. It assumes no formal training in statistics, but takes the reader on a tour of the most well known (and some less well known) statistical graphic formats. Henry's *Graphing Data*, on the other hand, is aimed at the professional researcher. It assumes greater statistical knowledge, including chapters on graphics for regression analysis and analysis of variance, and uses more sophisticated data and displays than Wallgren et al.

Wallgren et al. contains much valuable information. A student or researcher faithfully following their advice will produce charts consistently better than those usually found in either popular or academic forums. The examples given are many, and usually well-selected. Proper attention is paid to the basic chart formats, such as bar charts, pie charts, time series, and scatterplots. Of particular interest is the discussion of some of the more unusual formats, like barometer charts and statistical flow charts. The penultimate chapter, a check-list of steps ''before you start'' and ''when you (think you) have finished,'' is one which those of us who display data for a living would do well to memorize.

Yet the book, on the whole, is less than satisfactory. To begin with, it suffers from very poor editing. On several pages Swedish words appear in place of English, an artifact of the book's original language. (Even in the Table of Contents, chapter 12 is listed as ''Charts och layout.'') On page 80, the text refers to a comparison between Sweden, Turkey, and

the U.S.A., but the graph to which it refers compares Sweden, Turkey, and the European Community. Examples like this are far too numerous.

The authors are also too prone to sweeping generalizations. For example: ''The title should be placed above the chart and written in Helvetica, 10 or 9 points (depends on the size of the chart), bold.'' Always? Even if it's a poster, slide or overhead? And why, if titles are always written in Helvetica, do they inform us 55 pages later that for this book ''we have chosen Avant Garde for the titles?'' Or, ''for a large set of data it is usually best to draw a boxplot without whiskers because the extreme values are probably of little relevance and are not of interest to the reader.'' Well, sometimes, yes, sometimes no. Sometimes the extremes are the most interesting points.

Organization, too, could be much improved. In this aspect, the book shows the signs of having five authors. Chapter 2, for example, discusses the choice of chart types. It is not a bad discussion, except that the chart types themselves are not defined until succeeding chapters. What is a non-technical reader to make of a sentence like ''It would not be appropriate to use a histogram to illustrate a discrete variable'' when histograms are not discussed for another 20 pages? Even worse, the section on time series data makes several references to smoothing, but the book never informs the reader how this smoothing is to be done. This sort of carelessness ultimately dooms the book from the point of view of its intended non-technical audience, and the more sophisticated reader is likely to finish with a sense of sadness for what could have been. There is a crying need for a book of this type. Maybe a carefully reworked second edition will meet it.

Henry, on the other hand, has written a book which will be of great utility to its intended audience: applied researchers. The book is extremely well-organized. He begins with a discussion of basic graphic principles, proceeds to explore various data types and their related graphic forms, and concludes with a summary of how to achieve graphical competence. Henry also makes it easy to go back to the book and find what you want: Separate chapters deal with the display of proportions, the display of multiple units, trends and time series, graphs for correlation and regression, and graphs for *t*-tests and the analysis of variance. Relatively unfamiliar formats, such as star graphs and jittering, are discussed in enough detail to allow the reader to construct their own plots, but not to the degree that the less sophisticated reader is lost.

And he uses several data sets throughout the book, showing how different graphic formats serve to explain different aspects of the story the data are trying to tell us. Moreover, it is well-written, reaching heights of eloquence rarely seen in the statistical literature. ''A good graph looks stone simple. Simplicity permits viewers to go directly to the information, to view it, to see how it stacks up against their expectations, and if the graph is truly successful, to wonder.''

More than Tufte, Henry is cognizant of the need for the analyst to always consider their audience. ''Graphical competence is not achieved by preparing an exemplary graphic alone: The graph must be examined by the audience and the data retrieved from it. In revealing the data to viewers, the graph maker must stimulate their interest and facilitate accurate and efficient interpretation of the data.'' Perhaps the most valuable sections of the book are those discussing how the mind processes graphical displays, how different audiences are affected by different graphic formats and the benefits and limitations of using relatively unfamiliar types of graphics. He highlights research such as the finding

that readers judge proportions from pie charts and bar charts equally accurately, but that the pies take significantly more time to process (Simkin and Hastie, 1987), a substantial point in favor of bars. Henry points out the need for qualifications on Tufte's call for greater data density: ''Less data should be graphed when the graphical type is less familiar to the audience.'' And he realizes the importance of aesthetics, a subject other authors either dismiss or ignore. ''A public accustomed to bold graphs may overlook important data conveyed in shades of gray. Improving the aesthetics of data graphs will become an issue for applied researchers who want lay audiences to understand their work.''

I will keep both books on my shelf. Henry, however, is the one I will take down most often. It is the one I will ask my staff to read. And, most importantly, it is the one which has changed the way I look at and construct graphics.

References

Cleveland, W.S. (1985). The Elements of Graphing Data. Belmont, CA: Wadsworth and Brooks-Cole.

Cleveland, W.S. (1993). Visualizing Data. Summit, NJ: Hobart Press.

Simkin, D. and Hastie, R. (1987). An Information-Processing Analysis of Graph Perception. Journal of the American Statistical Association, 82 (398), 454–465.

Tufte, E.R. (1983). The Visual Display of Quantitative Data. Cheshire, CT: Graphics Press.

Tufte, E.R. (1990). Envisioning Information. Cheshire, CT: Graphics Press.

Tufte, E.R. (1997). Visual Explanations: Images and Quantities, Evidence and Narrative. Cheshire, CT: Graphics Press.

Don Feeney
Minnesota State Lottery
2645 Long Lake Road
Roseville, MN 55113
U.S.A.
Phone: (612)-635-8239 (work)
e-mail: don@msl.state.mn.us (work)
e-mail: carfeem@aol.com (home)