

suggests that care be taken to not make GIS into a system which is more real than our maps already appear. Third, map design has a dual nature in both analytical processes and intuitive (or, 'gut') processes. Finally, he suggests better education for maps users.

The real strength of the book is also its weakness. The editors have collected a truly broad set of perspectives. Within these pages, the reader moves between some very systematic approaches (Nelson and Gilmartin, Kumler and Buttenfield, McGranaghan, etc.), to more broadly philosophical ideas (Huffman and Belbin), to very practical strategies (Mersey, Monmonier). This 'big tent' approach is good for bringing out ideas. On the other hand, the variety of foci does not allow a truly detailed exploration of cartographic design. The papers tend to not be in-depth and are not conceptually integrated with each other.

To compound the issue, the authors in this volume vary in their interpretation of cartographic design. Some put forth broad theoretical statements that define design as a process which is analytical and intuitive. Other authors focus on research questions dealing with narrowly defined design elements. There does not appear to be any organization to the order of these chapters. The result is that ideas are often juxtaposed with one another, requiring the reader move between contrasts such as postmodernism, Gestalt theory, gender differences, maps and children, and feature matching.

Another problem with the book is that some of the equipment used in the studies can now be considered 'old' (monochrome LCD panels, 486 computers). Likewise, there is little mention of the influence of the World Wide Web on cartography; a venue that was just emerging at the time these

papers were presented in Ottawa in 1994.

The best use for this book would be in an advanced cartographic design class or seminar (although the book price may be prohibitive for students). The chapters are each conceptually independent and all of the readings offer a number of opportunities for discussion about design in a number of contexts: communication, cognition, philosophy, aesthetics, etc. Because the book covers such a wide range of viewpoints, most of the essays are bound to raise the ire of someone in a group discussion while simultaneously pleasing someone else.

The cartographic professional may come away with a mixed evaluation. On the one hand, no startling new breakthroughs in design theory and practice are offered here. Nor is there any consensus on cartographic theory in general. On the other hand, the reader will find the chapters igniting research questions and philosophical ideas in their own minds. By reading these diverse viewpoints, readers are prompted to re-evaluate and re-consider their own theories about cartographic design. Most of the authors make clear there are a variety of questions about design which are yet unanswered, and they provoke new ones in their writings.

It is unfortunate that this book does not include any significant interaction between the chapter authors. Given the range of beliefs expressed here, it might have been interesting to have the authors critique and respond to each other. There are a number of differing points of view, but the reader is left with the idea that there is no conflict, or controversy among them. How can we discuss cartographic design without actively discussing the areas of agreement and especially disagreement amongst ourselves?

Geographic Information Systems: A Visual Approach. Bruce E. Davis. Santa Fe, NM: Onward Press, 1996. 374 pages, about 175 diagrams. Paperback. ISBN 1-566900-098-0.

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In this day of proliferating Geographic Information Systems (GIS) textbooks, Bruce Davis provides an interesting departure from the norm in his book, *Geographic Information Systems: A Visual Approach*. Davis teaches at the University of the South Pacific in Fiji; English is often a second language for his students and their exposure to computer technology has not been as ubiquitous as most GIS book authors expect. With these limitations in mind, Davis has written a simple handbook of GIS technology and concepts that would satisfy the novice as well as those more technologically sophisticated.

The "visual approach" used by Davis is to present each concept on two facing pages: the left page has a graphic description of the concept, and the right page explains the concept verbally and makes reference to the graphic. This format is used for all eleven chapters of the book. The book is a quick read, two afternoons at most, and I found myself looking at the graphics first and then reading the text only if I needed more explanation of the visual presentation.

The book covers all concepts necessary to understand what a geographic information system is and how it works. Chapter 1, "GIS and the Information Age," is a brief introduction to information and the need to manipulate it. Davis articulates the importance of this by stating that "Information is the heart of GIS (pages 14-15)." It

is in this chapter where he discusses the concept of visualization and explains GIS organization, infrastructure, and principles.

Chapter 2, "What Does GIS Do?" briefly describes a GIS's functions: location, measurement, attribute definition, patterns and relationships, and trends. Davis provides a definition of modeling and shows how GIS is useful in this regard.

Chapter 3, "Spatial Data," discusses databases, attributes, and their manipulations. Terms such as data, information, attributes, and spatial data are defined here. Davis also describes a typical spatial database and its uses.

Chapter 4, "Raster and Vector Data," explains these two data structures, conversions between them, and their respective advantages and disadvantages. The discussion considers maps as both input and output for spatial data and display.

Chapter 5, "Topology," explains the concept of topology and its usefulness in manipulation of data containing spatial relations.

Chapter 6, "Data Entry," describes data acquisition. Several pages are devoted to remote sensing, and there is one section on digitizing and another one on database construction. Georeferencing is defined in terms of coordinate systems and map projections. Davis also presents a brief section on Global Positioning Systems and their use in data capture.

Chapter 7, "Inventory Operations," discusses extraction of basic data and information from databases, including Boolean queries, and simple coverage editing operations. Here Davis discusses measurement applications, coverage modification, dissolving, and recoding.

Chapter 8, "Basic Analysis," moves on to overlay analysis, graphic manipulation, and buffer

zones. Recoding is more fully explained and used. Overlay analysis is discussed in detail, as are map algebra and matrix operations.

Chapter 9, "Advanced Analysis," discusses proximity analysis, clustering, terrain analysis, routing, and various graphic operations. This chapter starts to tie together all the previous concepts and to synthesize them for use in concrete problems, such as routing and terrain analysis.

Chapter 10, "Site Suitability and Models," applies the concepts presented in the previous chapters to a typical GIS problem: where to locate something. Here, types of GIS models, such as time-series, environmental, statistical, sensitivity, and other models are discussed.

The concluding chapter, Chapter 11, "Data Issues and Problems," addresses the fact that, without accurate data in the first place, the resulting GIS analysis is worthless. A brief glossary and an index make up the final pages of the book.

This book's strengths are its simplicity and its independence of particular GIS software. The author does an excellent job in addressing the needs of his intended audience. He explains the concepts in such a way that computers are not even needed to understand what a GIS does. This book could be used to teach a class in which all the exercises are done on paper, where students do not have access to a 'real' GIS; yet they would still gain a strong understanding of what a GIS does and how it works. This book could also be useful for schools with GIS programs, since good basic definitions of GIS concepts and methods of analysis are always welcome. In a more technologically sophisticated setting, the book should be supplemented with material applicable to the specific computer environment.

While simplicity is one of the book's strengths, it is also one of its weaknesses. In its goal for simplicity some terms lack adequate definitions. For example, the 'G' of GIS is finally linked to 'geography' on page 21, long after GIS, the acronym, has been expected to be understood. 'WYSIWIG' is referred to but is never defined, making it more difficult to understand its impact by not understanding the acronym. There is some confusion as to whether the word "data" is singular or plural. "Data is" and "data are" are used interchangeably, although Davis does address this in Chapter 3 by writing, "Technically we say 'datum is' and 'data are,' although data is commonly used as both the singular and plural form (page 59)." We do seem to be moving in the direction of "data is" and, for folks for whom English is a second language, I would think that Davis would have chosen one use and followed through with it.

These latter points, however, are minor. This book is useful to anyone interested in the basic concepts of GIS, whether a student in a GIS class or someone who is expected to quickly develop an understanding of new technology. In most university GIS lab settings, this is a good supplement to specific software manuals. For programs just starting to teach GIS, this is a good beginning text.

Raster Imagery in Geographic Information Systems.

Stan Morain and Shirley Lopez Baros, Editors. Santa Fe, New Mexico: OnWord Press, 1996. 536 pages, bw and color maps and illustrations, list of contributors, contact points, and subject index. \$59.95, paper (ISBN 1-56690-097-2).