

BOOK REVIEWS

Books

MAPPING SCIENTIFIC FRONTIERS — THE QUEST FOR KNOWLEDGE VISUALIZATION, by Chaomei Chen, Springer, London, 2003, 240 pp., €80 (hbk), ISBN 1-85233-494-0.

Maps and mapping play vital roles in social and scientific activities throughout human history. We map the Earth and other celestial bodies, we map the brains and genomes of human beings and animals, and we map the virtual worlds that are becoming more dominant in our modern society. Apart from its role in communicating our physical environment, the map metaphor has been applied to the study of various aspects of society, including the presentation of scientific results. In this book, Chaomei Chen here describes another interesting usage: the application of mapping to scientific frontiers, from the perspective of visual thinking and visual exploration in the quest for the discovery of scientific knowledge.

Cutting across the boundaries of several independent disciplines, the book sets out to explore the possibilities of information visualization and how this can enhance studies of information science, especially scientometrics (quantitative studies of scientific discoveries and scientific paradigms) and bibliometrics (quantitative analysis and statistics to clearly describe patterns and structures of publication within a given field). The title 'Mapping Scientific Frontiers' should therefore be regarded as both map metaphor and as an interactive visualization for the understanding of science. The mapping process itself is examined using various analytical models that are fundamental to visual thinking and visual exploration.

The book can be divided into three main parts, focusing on background, analytical models and case studies for mapping scientific frontiers. The first chapter sets the scene for the whole book and deals specifically with the dynamics of scientific frontiers, mapping in general and interactive visualization in particular. To this end, the first chapter reviews the use of maps, figures and diagrams in visual communication about science, and explains how visual tools help to augment human ability in perception and cognition. It also reviews the emergence of the discipline of information visualization, which is 'about the use of interactive visual representation of abstract data to amplify human cognition'.

Chapter Two summarizes the origin and evolution of cartography and suggests how the two main categories of maps (i.e., general reference maps and thematic maps) can be combined as a powerful tool to describe various phenomena. Of special interest to cartographers is perhaps Chen's selection of topological maps representing abstract data, where interestingly, the author includes a variety of maps to illustrate the text, with subjects ranging from terrestrial and celestial to biological, including classics such as Charles Minard's map of Napoleon's ill-fated march to Russia, John Snow's map of cholera cases and Harry Beck's map of the London Underground.

Given the complexity of the structure and large size of data sets, a range of analytical models is then introduced for the purpose of knowledge discovery and data mining. The analytical models include multi-dimensional scaling, clustering, network analysis (Chapter 3), pathfinder network scaling, self-organizing maps, principal component analysis (Chapter 4), co-word maps and co-citation analysis (Chapter 5). More importantly, the emerging 'small-world' model relating to the study of complex networks is also introduced. Throughout these chapters, effective and efficient visual tools that have been developed are linked to models for knowledge discovery and pattern recognition. It is demonstrated that visual tools can indeed enhance human capacity

in perception and cognition, for instance, through dimension reduction and clustering processes.

To further illustrate the power of visualization in mapping scientific frontiers, the final section of the book includes some case studies. These include the mapping of scientific paradigm shifts, using diverse examples such as the extinction of the dinosaurs and the phenomena of black holes. This part ends with the presentation of ten challenges facing the mapping of scientific frontiers.

The application of mapping demonstrated in the book is fully computer-based and relies on analytical models for visual thinking and visual exploration. There is a clear shift within this genre of mapping away from the creation of geometric maps to that of topological maps. This shift started initially in cartography and is now penetrating deep into the emerging discipline of information visualization. This kind of topological mapping is of value in illustrating hidden structures and patterns with a geographic system.

Contributed by an expert in information science, and information visualization in particular, this book can be an important text for cartographers. A distinguished feature is its colourful maps and illustrative figures, making it more readable. The book is likely to appeal to a wide audience from a variety of disciplines, involving the philosophy of science, information retrieval, scientometrics, bibliometrics, domain analysis and also information visualization. The book forms a significant contribution to the mapping of knowledge domains, as well as to the emerging fields of scientific visualization, geovisualization, knowledge discovery and to applications involving data mining using large databases.

BIN JIANG

Division of Geomatics, University of Gävle, Sweden

MAPS AND MAP-MAKING IN LOCAL HISTORY, by Jacinta Prunty, Four Courts Press, Dublin, 2004 (Volume 7 in Maynooth Research Guides for Irish Local History). 160pp., £50 (hbk) £19.95 (pbk), ISBN 1-85182-699-8.

Jacinta Prunty's *Maps and Map-Making in Local History* is ostensibly a book of the history of Irish maps and their makers; *who* made them, *when* and *where* they were made and *why* they were made in the first place. One element that differentiates this book from other cartographic histories is the invaluable information on *how* to go about finding such maps, an activity that can be daunting to those who are unfamiliar with this aspect of cartographic research. Prunty argues that maps can provide evidence or information that may otherwise remain occluded to the historian, archaeologist or anybody interested in the cultural history of a country. In the foreword, J. H. Andrews notes the hesitancy of some cartographic scholars to 'write of truth and accuracy at all except under the protection of inverted commas'. He argues that we have to ask whether cartographic language 'happens to be telling the truth'. Both Andrews and Prunty agree that in reading maps, one has to be aware of the different valencies of cartographic language, but while Andrews seems to adhere to a more positivistic mode of interpretation (the map has a singular truth to tell the discerning historian), Prunty appears to move more in the direction of an interpretive pluralism and argues that maps can be read like literary texts, where the context, modes of production and intention of the mapmakers all come into play. Prunty makes the important link between maps and knowledge when she writes 'connections between power and knowledge are readily made; connections between political power and cartographic knowledge are inescapable'.

While mapmaking as a science may occasionally have the appearance of being a value-free activity, we are informed (particularly in relation