

companies noticed the potential of such systems and many other applications were produced. Since the mid-eighties there has been a boom of publications in the area of expert and knowledge-based systems, ranging from the most technical collection of papers, to the most general user oriented that claimed that you could write an expert system in your favourite microcomputer programming language. However, there have been few books that could explain to the non initiated public all the ideas, concepts and methods used to build an expert system.

When building an expert system there are at least two experts interacting, the knowledge engineer and the expert in the specific domain. The knowledge engineer will help the domain expert to clarify and formalize his knowledge in such a way that it can be fed into a computer. Initially, both will be ignorant of the other's domain, so a great amount of time is spent training each other. This book aims to instruct the human expert, so the time spent in the initial phase of development of a expert system is reduced. Moreover, as more and better expert systems development tools appear in the market, it should be possible for an expert to use the tool directly and produce the expert system without the help of a knowledge engineer.

This book will help those human experts who need to augment their knowledge of expert systems, but who do not necessarily know anything about computer science. It will also help those people, non experts, who want to have a good idea of what an expert system is and all the tools needed to build one.

The book is organized in nine chapters and four appendices. The appendices are used to give the reader a background of some concepts needed for a better understanding of the book. There are appendices for each methods, general-purpose reasoning, propositional logic and relational databases.

Within the chapters, the reader receives a good background on expert systems, and introductions to logic, knowledge, knowledge representation using frames, uncertainty, inference and, finally, some issues on building expert systems and knowledge acquisition. It also provides a very large bibliography (around 650 references). A good number of figures and examples help our understanding of the many different concepts introduced. However, just because of the large amount of new information, some people may feel overwhelmed by the jargon.

I would recommend the book to anybody that needs a good introduction to expert system concepts and methodology.

The visual display of quantitative information by E. R. Tufte, Graphic Press UK, 1988, pp 197, £20.

The correct and aesthetic display of information in graphs and diagrams is a skill required by researchers in all fields. Unfortunately obtaining this skill is often a case of trial and error or complaint and compliment learning, with people rarely being explicitly taught how to produce good data graphics.

This book sets out clearly, with many illustrative and amusing examples, a theory of data graphics and principles for graphical excellence. Tufte has put his many years of experience and research—he was a consultant in the design of IBM's Presentation Manager interface—into this highly useful and entertaining book. The result is a wonderful collection of both good and bad data graphics from the earliest Playfair histogram to the latest computer generated maps.

The first part of the book concentrates on providing examples of good graphical design, from a tenth century time series plot, to what Tufte regards as possibly the best realization of data in graphical form ever: CJ Minard's illustration of Napoleon's Russian campaign.

The next section is devoted to "graphical integrity", and has many examples of misleading graphical representations from a wide variety of ostensibly responsible publications. One illustration from Time magazine uses increasing barrel size to represent rising oil prices over time, with an actual price rise of 454% being depicted by a barrel whose volume increases by 4,280%—a "lie factor" of 9.4. Tufte points out ways to avoid being taken in by, and producing, misleading diagrams and

graphs. The book includes a chapter on aesthetics and technique which I found especially useful; containing simple and applicable guidelines on how to produce clear and attractive data graphics.

Tufte's theory incorporates a number of principles for producing good data graphics. Perhaps the most important of these is "maximize the data-ink ratio". One of Tufte's definitions of the data-ink ratio is the "proportion of a graphic's ink devoted to the non-redundant display of data information". According to this principle one should endeavour to minimize those parts of a graphic containing information available in other parts, and to delete areas which may be safely taken out without loss of data or comprehension. Therefore, grid lines and axes should be erased from a diagram where possible. Another principle is "eliminate chartjunk". Chartjunk is decoration or frills which add nothing to the data displayed and which may cause the data to be obscured. A common example of chartjunk may be seen in histograms, whereas sometimes line shading of alternate bars can make the bars appear to fall in on each other, or produce disturbing visual phenomena called Moiré effects.

It is good to see the wide range of publications from which material has been drawn. Figures are taken from such varied sources as *The New Yorker* and *Pravda*, with diagrams illustrating such graphical delights as the "Shrinking Family Doctor", and a Parisian train timetable set out as a time series graph.

My one problem with this book is that Tufte sometimes goes too far in his evangelical pursuit of graphical excellence. For example, the data-ink maximizing examples are praised as being much more communicative and effective than graphic which retain "redundant" features such as grids or labels but are, I suspect, far too bare to be regarded as aesthetic or easily interpretable by the average reader. It is also becoming increasingly difficult to implement the type of design decisions the author advocates. I suspect that nowadays hand-drawn graphics are very rarely produced for publications or reports, authors choosing instead to employ computer packages for this time consuming task and use the default graphic provided.

Throughout the book the author's style is straightforward, clear and readable. The 150 diagrams are well chosen and always seem to illustrate concisely points being made in the text. The contents are ordered logically, and the index is extensive. The quality of product is undeniably excellent and overall the book amounts to a true bargain for the price. I would recommend that this book be given to every researcher and scientist on their first day, with instructions to read, learn and enjoy.

Crafting knowledge based systems by Jon Walters and Norman Nielsen, J. Wiley Interscience, Chichester 1988, pp 342, £18.95.

What motivates a knowledge-based systems author to put pen to paper? There are probably as many reasons as authors. But in this case, I would hazard a guess that there is a degree of proglatizing for the authors' approach to building expert systems.

This approach is a little bit non-standard—as you may have guessed from the title. They put forward the philosophy that knowledge-based systems are arty (or artful) systems to be crafted, rather than scientific tools to be engineered. This sets the scene for a different slant on the subject which is at times highly interesting and at times rather unusual. Each chapter for example, starts with a photograph of some aspect of yacht building and relates it to knowledge-based systems production.

The book's covers modestly describes the content as "describing the entire process of building a knowledge-based application from concept to operational use". It goes on to promise that it is "packed with advice and examples based on the author's own experience", and that I would not dispute. In fact the content is divided into three parts, planning and design, development (or crafting) and knowledge representation. It is in planning and design that some of the author's more interesting outlooks are to be found. They advise, for example, that all knowledge elicitation interviews should be conducted by two knowledge crafters, who take it in turns to ask the questions.