FOREWORD

I see what you mean. This common expression illustrates the deeply-held intuition that vision and artful images are an alternate and seemingly direct route to *insight*, which is itself another of the many words or phrases relating to vision and understanding. *A picture is worth 10,000 words*, to quote another example. Over history, visual abstractions have been developed to aid thinking: pictures from antiquity, maps from ancient Egypt, the geometry diagrams of Euclid, and the statistical diagrams of Playfair. In fact, disciplines of practice have grown up around how to do these: cartography; mechanical drawing; electrical schematics; information design for signs, labeling, and books; and statistical data graphics.

Information visualization, which is the use of interactive visual representations of abstract data to amplify cognition, is the latest of these disciplines. Because of the computer, information diagrams or visualizations can be prepared automatically at time of use, can be made dynamic and interactive, and can be integrated into a larger process of sensemaking and creation. The potential for information visualization is vast. Staggering advances in interactive computer graphics over the last two decades potentially enable building systems that give rapid insight into information-intensive problems in medicine, finance, business, and scholarship. But the design of information visualization systems is also very subtle, and there needs to be a supporting science for how to do it.

New disciplines or areas tend to go through phases. First there is the phase of exploratory design—point designs that explore the space of what can be done with the new capabilities. This has already been completed for information visualization. Then there is the characterization phase, taxonomizing or otherwise organizing the methods that have been developed and developing theories of what works. This is the current frontier of information visualization and the one most directly attacked in this book. It is necessary to progress to the future stages of validating that the theories can be used to form new designs and, finally, the codification into handbooks of engineering principles.

What information visualization is really about is external cognition, that is, how resources outside the mind can be used to boost the cognitive capabilities of the mind. Hence the study of information visualization involves analysis of both the machine side and the human side. Almost any interesting task is too difficult to be done purely mentally. Information visualization enables mental operations with rapid access to large amounts of data outside the mind, enables substituting of perceptual relation detection for some cognitive inferencing, reduces demands on user working memory, and enables the machine to become a co-participant in a joint task, changing the visualizations dynamically as the work proceeds.

Successful design of information visualization systems depends on adequately characterizing the task, the human visual system, visual displays, and the dynamic interaction among all of these. The apparent simplicity of seeing belies the complex mechanisms to achieve it. Colin Ware has written a book that brings together what is know about information visualization and its connection to vision, perception, and visual cognition. He is the perfect person to do it, with a long history of prominent contributions to the visual interaction with machines and to information visualization directly. This book starts with the visual system and moves out to its interaction with displays, visual forms, and tasks. It fills in and makes accessible much of the supporting science needed for the progress of this field beyond intuitions of what makes a useful picture. tithes book goes a long way toward joining science to the practical design of information visualization systems.

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