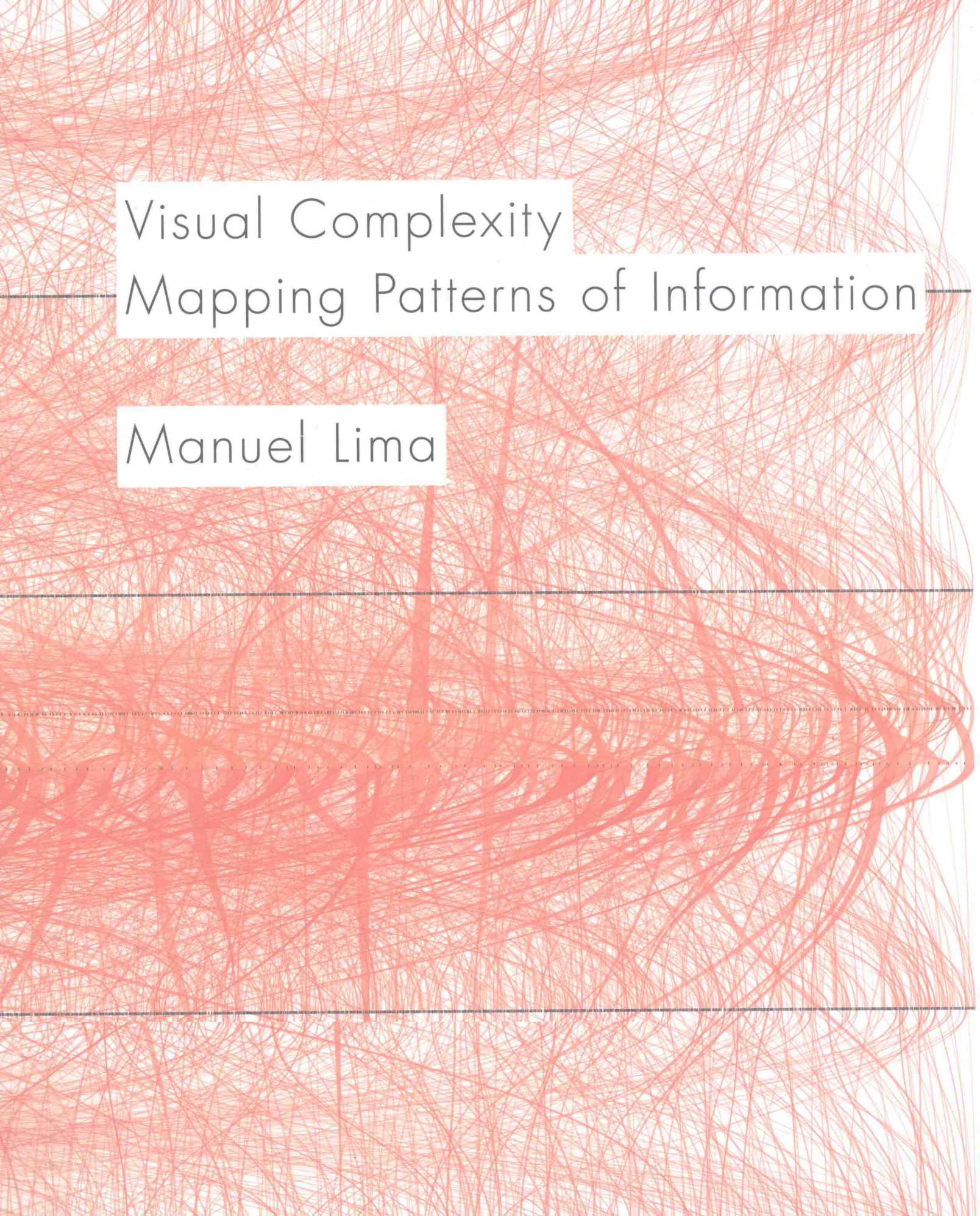

Visual Complexity
Mapping Patterns of Information

Manuel Lima

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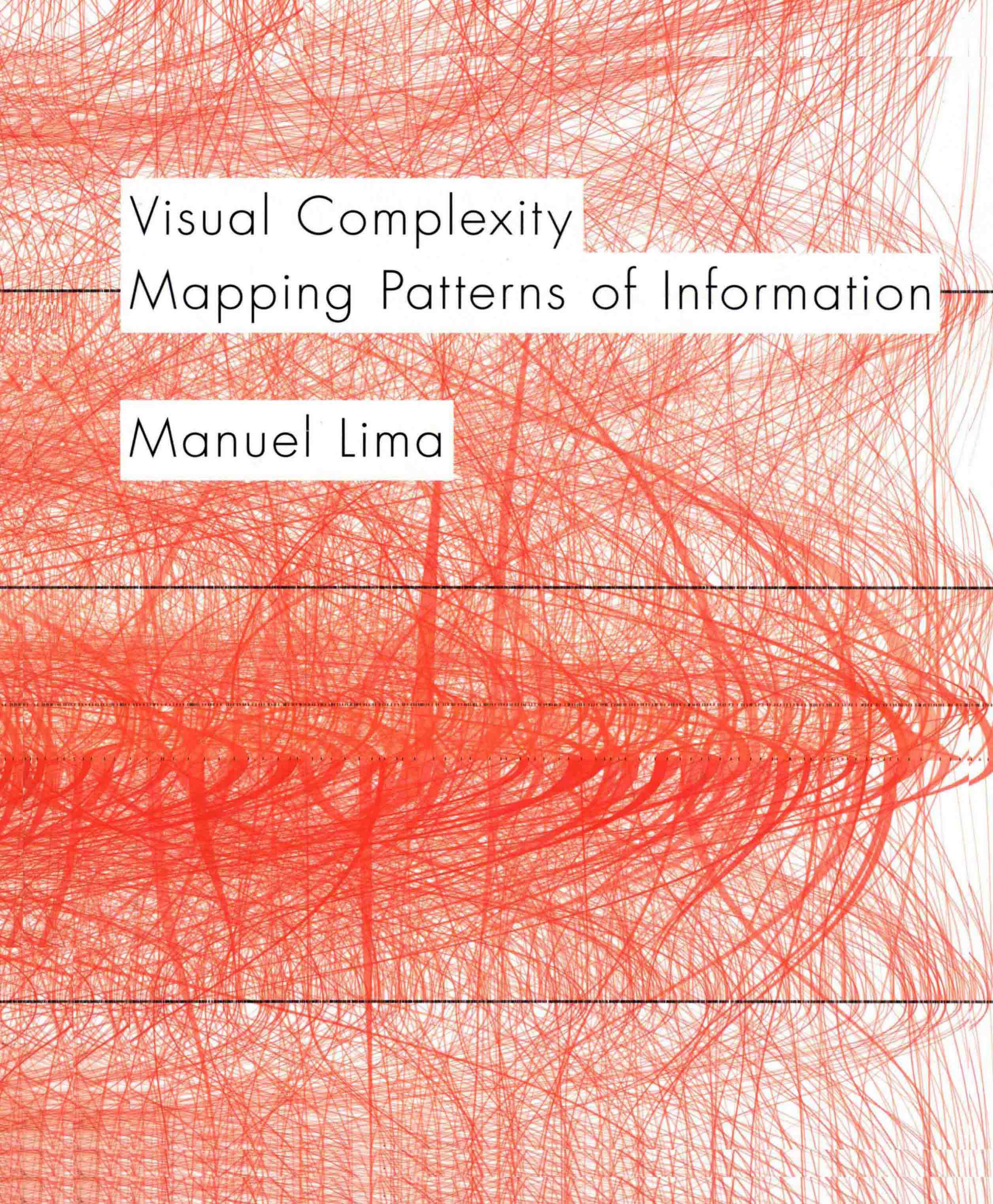

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Mapping Patterns of Information

Manuel Lima

"Manuel Lima might well become the Edward Tufte of the 21st century." —*Creativity*

Our ability to generate information now far exceeds our capacity to understand it. Finding patterns and making meaningful connections inside complex data networks has emerged as one of the biggest challenges of the twenty-first century. Designers, researchers, and scientists now employ an innovative mix of color, symbols, graphics, algorithms, and interactivity to clarify, and often beautify, what would otherwise be a clutter of data.

In *Visual Complexity: Mapping Patterns of Information*, Manuel Lima collects and presents almost three hundred of the most compelling examples of information design—everything from representing networks of followers on Twitter and the eighty-five recorded covers of Joy Division's "Love Will Tear Us Apart" to depicting interconnections between members of the Al Qaeda network and interactions among proteins in a human cell. Lima also looks at the long tradition of mapping complex networks, offering the first book to integrate a thorough history of network visualization with an examination of the real-life situations from which these graphics are generated.

Network visualization is the language of representation in today's information-driven society. *Visual Complexity* explores and reveals the importance and impact of illustrations not only in understanding complex concepts but as the central driver for a new conception of beauty. With essays by prominent voices in the fields of network sciences and information visualization, Visual Complexity includes contributions by Christopher Kirwan, Nathan Yau, Andrew Vande Moere, and David McConville.

About the Author

Manuel Lima is the founder of VisualComplexity.com and a Senior UX Design Lead at Microsoft. He is a Fellow of the Royal Society of Arts and was named by *Creativity* magazine as "one of the 50 most creative and influential minds of 2009."

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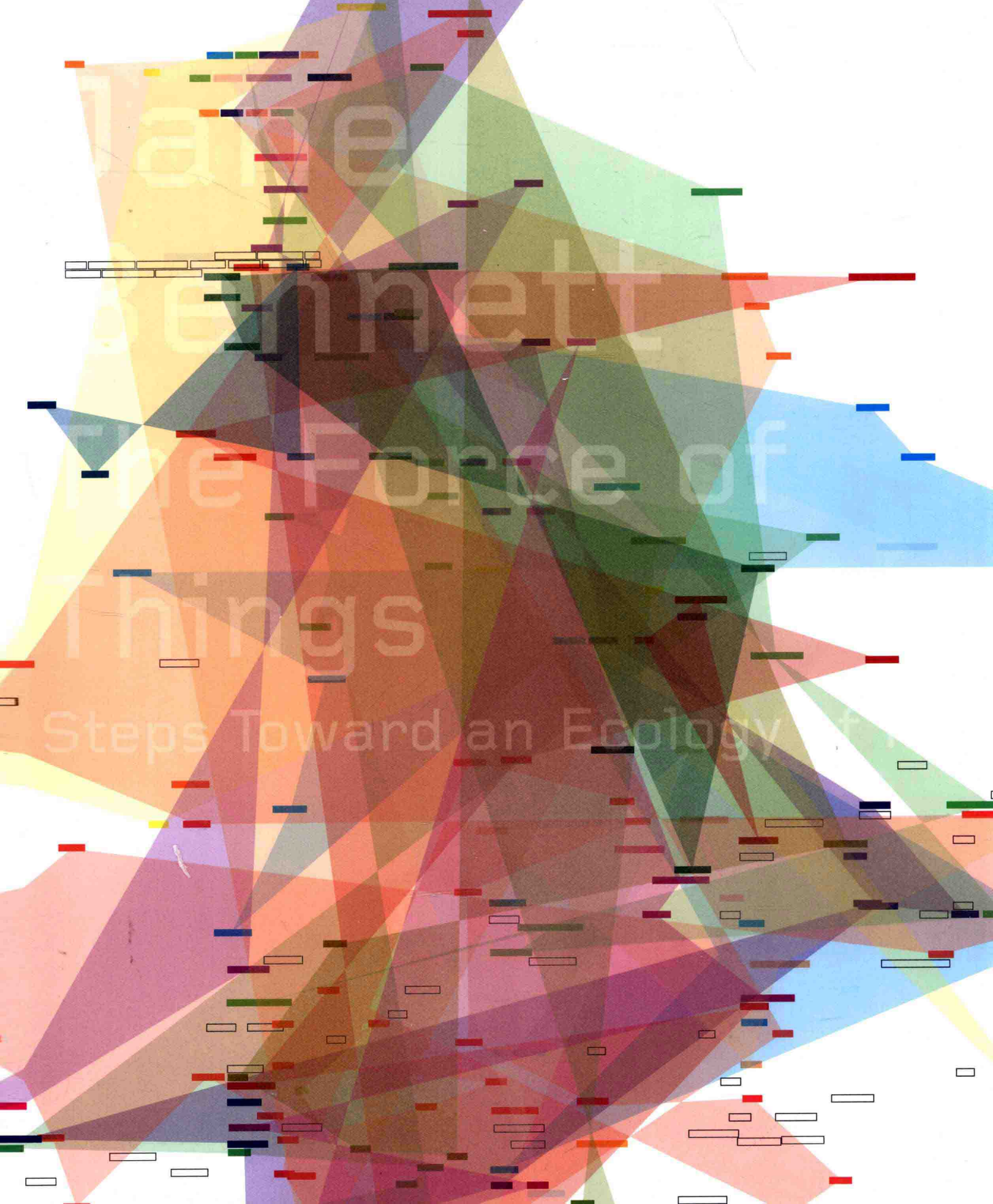
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To my parents, Jorge and Maria Luisa, and my wife, Joana

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Foreword

Lev Manovich

Visual Complexity looks at the intersection of two key techno-cultural phenomena of our time: networks and visualization. Both were relatively unknown only fifteen years ago but have since moved to the forefront of our social and cultural lives. While some social scientists had already started to study networks in the middle of the twentieth century, globalization and the rise of the web in the nineties and the explosion of online social networks in the last decade have drawn attention to their importance. Furthermore, although scientists had already been making graphs and charts of their data since the early nineteenth century, the ubiquity of computers, the growing programming literacy, and the wealth of data unleashed by networks at the turn of the twenty-first century democratized information visualization, making it a rapidly expanding new area of art and culture.

Author Manuel Lima is a thinker, designer, lecturer, and curator of one of the most influential online galleries that presents the best projects in information visualization: Visualcomplexity .com. However, in contrast to other important galleries that try to cover all of information visualization, Visualcomplexity. com is focused on visualizations of networks. As its ongoing curator, Lima is likely to have the best understanding of the creative impulses, exciting discoveries, and sheer range of work produced today in this area. Imbued with Lima's expertise, this book will become the essential reference for all practitioners and fans of network visualization—or, to use Lima's more evocative language, visualizations of complexity.

Many books on the recently emerging areas of software-driven design—web design, interaction design, motion graphics, and information design, for example—are simply visual portfolios. Others are how-to books that present techniques, "best practices," and practical step-by-step guides. Although we can often extract a few paragraphs or pages of important theoretical insights from both types of books, these passages usually represent only a very small percentage of a whole book.

If visualization of complex data is well on its way to becoming as important to the twenty-first century as photography and film were to the twentieth century, the time for books that encapsulate its main ideas and concepts has arrived. *Visual Complexity* is the first such book. Lima establishes conceptual coordinates and historical trajectories for both practice and appreciation of visualization. He also balances historical and theoretical discussions of larger issues with the presentation of exemplary projects in network visualization.

The rise of information visualization over the last fifteen years raises many important and interesting questions about the identity of this new medium. For example, what exactly is the difference between the hundreds of projects collected in Visualcomplexity.com's gallery and the standard graph—bar charts, pie charts, scatter plots, line charts, and so on—that many of us are routinely producing using Excel, Apple's Numbers, Google Charts, or similar software? These graph types—which were all originally invented in the first part of the nineteenth century and have therefore already been in use for about one hundred years before digital computers—share a lot in common

with "digitally native" information visualization techniques developed more recently. Both depict quantified data by systematically mapping it into visual images. Both use the same graphic language: points, lines, curves, simple shapes, and other graphic primitives.

Interestingly, this language of information visualization also has many parallels with the language of geometric abstraction, which crystallized in the second decade of the twentieth century through the work of Piet Mondrian, Kasimir Malevich, Frank Kupka, and other modernist artists. However, if these artists wanted to liberate visual art from its representational function—i.e., its dependence on "visible data"—information visualization brings representation back. But this is a new kind of representation appropriate for information society: rather than representing the visible world, we now seek to represent—in order to understand—all kinds of data sets.

So what else is unique about information visualization? There are many possible answers to this question, although no single response can completely capture all the differences. Most of the projects discussed in this book are visually more dense, more complex, and more varied than the familiar charts created with graphing software. Why is this the case? First, contemporary designers, artists, and computer scientists are trying to represent considerably more data than ever before. Second, they want to represent relations between more dimensions of data than is possible with older graph types such as bar charts (one dimension) or scatter plots (two dimensions). The third reason is aesthetic and ideological: if nineteenth-century techniques for graphs fit the scientific paradigm of reduction (breaking nature down into the simplest possible elements and defining rules on how these elements interact), our current interest lies in understanding the phenomena of complexity (think chaos theory, emergence, complexity theory), which is reflected in the kinds of visualizations we find appealing.

We can also explain the visual variety of information-visualization culture. It comes from the systematic effort on the part of its practitioners to invent new visualization techniques, which is rewarded both in academia and in the cultural world. Additionally, since visualizations are now valued as artistic and cultural artifacts, we expect them to be unique—just as we expect this in fashion, product design, architecture, music, and other cultural fields.

Another question that inevitably comes up in any discussion of information visualization is whether it falls in the category of science, design, or art. Here is my proposal: rather than identifying visualization culture with a single category, let us consider it as existing in the space defined by all three.

Information visualization is widely used as a tool for understanding data—i.e., discovering patterns, connections, and structure. Since science is the area of human activity targeting the discovery of new knowledge about the world through systematic methods—such as experimentation, mathematical modeling, simulation—visualization now functions as another of these methods.

What distinguishes this new method is that it also firmly belongs to design—it involves the *visual* presentation of data in a way that facilitates the perception of patterns. Just as a graphic designer organizes information on a poster or web page to help the user navigate its layout efficiently, an information-visualization designer organizes data to help users see the patterns. At the same time, just like graphic designers, information-visualization designers do not only aim for efficiency and clarity. They chose