

Smolin, a critic of the more extravagant pronouncements of string theorists, now declares that his view of time is “the key to the meaning of quantum theory and its eventual unification with space, time, gravity, and cosmology.” He claims to show—not argue or contend, but show—that “no extension of the Newtonian paradigm can yield an acceptable theory of the universe as a whole.” He asserts that “the only way to avoid the fallacy and the paradox of an improbable universe is to base our explanation ... on time-asymmetric physics.” In the book’s last chapter, he finally steps back and confesses that he is merely “try[ing] to construct reasoned arguments.” But that’s too little, too late.

Again, experts will discount the hyperbole. But lay readers are liable to conclude that Smolin is clearly right and that other physicists are just being pigheaded in not following his lead, or, worse, that correctness in physics is essentially a matter of opinion.

Would I recommend the book? To a colleague, yes: While portions are irritating, it is valuable to have to think about the issues it raises, even if only to clarify one’s disagreements. To a lay reader, only hesitantly: perhaps as part of a reading list that could also include Sean Carroll’s *From Eternity to Here: The Quest for the Ultimate Theory of Time* (Dutton, 2010; reviewed in *PHYSICS TODAY*, April 2010, page 54); Julian Barbour’s more difficult *The End of Time: The Next Revolution in Physics* (Oxford University Press, 1999); and, for an ambitious reader, Robert Geroch’s wonderful *General Relativity from A to B* (The University of Chicago Press, 1978; reviewed in *PHYSICS TODAY*, May 1979, page 71).

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Visual Strategies A Practical Guide to Graphics for Scientists and Engineers

Felice C. Frankel and
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Yale U. Press, 2012. \$35.00 (160 pp.).
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The production of figures, which have always been essential in physics publications, has undergone a revolution. A figure used to be an x - y plot, drawn



by a draftsman, graphically showing the behavior of data. Now, figures illustrate so much more; x - y plots are supplemented by a plethora of figure types whose variety is driven by the increasing sophistication of computer graphics software and fed by ever-expanding data sets. For example, what used to be simple x - y plots are now in color or in three dimensions, and descriptions of experiments are now frequently supplemented by sophisticated “how-to” schematics. The design and production of computer graphics is much more complex and challenging than in days past.

Science photographer Felice Frankel and systems biologist Angela DePace offer a wonderful solution to the problem. *Visual Strategies: A Practical Guide to Graphics for Scientists and Engineers* is a how-to book on effectively utilizing modern computer graphics. Both authors have extensive experience in presenting complex data.

The book is focused on the use of drawings to illustrate structure and process, primarily in the life sciences, but the authors also give some attention to the physical sciences. Data sets are now so complex, the authors state, that they are better presented with structure-and-process drawings than with traditional x - y plots. And indeed, the most useful types of figures today are the ones that have benefited the most from advances in computer graphics. It is in introducing those that the book really shines.

Visual Strategies is intended to be a useful tool for scientists in their day-to-day graphics preparation. It is divided into sections with indented tabs for easy access. Rather than present a discussion of a theme or topic, the book instead is a compendium of specific examples chosen from the literature. In each case, the authors dissect a published graphic and make suggestions as to how it could be improved.

That approach is effective in getting specific about how graphics can be best presented, but it is less convenient for finding specific ideas for graphics than a more expository presentation would be. For that reason, the book is better suited to scientists already well-versed in data presentation who want to improve their skills—a target audience that probably includes the majority of scientists.

The presentation of basic concepts in the first three chapters reflects the authors’ views on the goals and purposes of graphics. Chapter one covers form and

structure. It is a primer on how to present such data as the shapes of complex biomolecules or atoms on a surface probed with a scanning tunneling microscope. The authors point out that shape information is like complex data structures, which, unlike simple x - y plots, involve more than two number sets.

Chapter two describes figures that represent the time evolution of a process; they can include a sequence of images from a movie or a depiction of how some process evolves, or a sequence of figures describing the how-to of an experiment. Because such figures are often essential and are becoming increasingly sophisticated, the authors’ suggestions about them are of particular value.

Chapter three covers the comparing and contrasting of data sets, an essential step of organizing complex data. The key task addressed is how to take data subject to multiple interpretations and present them so that the author’s conclusion comes through clearly. The fourth chapter is a collection of specific case studies that combine the material of the earlier chapters and offer additional concrete realizations of the strategies the authors have presented. The fifth chapter discusses computer graphics that allow viewers to interact with the data; those graphics are restricted to online papers.

Perhaps the best way to judge this how-to book is to ask whether it can actually help you. Indeed, one example was chosen from a paper by my research group, which presented data that were quite difficult to convey. The postdoc who did that work is quite artistic and made what I thought was a good figure. Still, *Visual Strategies* made excellent suggestions that would have greatly improved our figure.

I think others will find similar value in this excellent book.

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Simple Brownian Diffusion An Introduction to the Standard Theoretical Models

Daniel T. Gillespie and
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Diffundere, the Latin origin of the word “diffusion,” means “to spread out.” Diffusion is practically ubiquitous and takes place in solids, liquids, and gases.