The criminalization of knowledge threatens our creative cultural traditions. Demoting geeks from Internet heroes to thieves, guerrilla warriors, and spies . . . will have consequences. . . . The point is only that it's foolish to think of the creative technical traditions as a bottomless well that will never run dry—a kind of genetic birthright to which European civilization will always be entitled. These traditions sprang into being quite by accident during the Renaissance and have no more imperative to exist forever than an auk or a dodo.

Once again I, like Laughlin, fear the possibility that future generations will be significantly less creative than our own. But I cannot believe that such a diminution of human creativity, if it does occur, is more likely to be a consequence of modern economic activity, patent law, and security restrictions than of war, pestilence, and energy shortages. Actually, I foresee that the recent remarkable loosening of social restrictions in the US, exemplified inter alia by the election of Barack Obama and the growing willingness to legalize same-sex marriages, will stimulate an enduring flood of creativity in a wide variety of disciplines, including the sciences. In so writing, I am quite aware that this is a review of Laughlin's book, wherein what I foresee should be irrelevant. However, I could find nothing in the book that would make my prediction unreasonable.

All in all, I found *The Crime of Reason* quite interesting and am glad to have read it. I recommend you read it too. You'll enjoy it, though I doubt you'll agree with its thesis.

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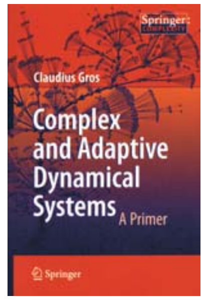
Complex and Adaptive Dynamical Systems

A Primer

Claudius Gros
Springer, Berlin, 2008. $69.95 (250 pp.). ISBN 978-3-540-71873-4

Inherently interdisciplinary, the study of complex systems draws on a range of computational and analytic methods, applies those methods to a broad and growing number of phenomena, and attracts the interest of researchers and students with various levels of mathematical preparation. Complex systems have many strongly interacting degrees of freedom and exhibit unexpected or interesting dynamic or collective behavior. However, even those who study complex systems do not agree as to what, exactly, those systems are or what models should serve as exemplars for them. Nevertheless, the field continues to grow. The subject draws students and researchers alike because of both the promise of its techniques to give insight into challenging and important scientific questions and the fun and excitement of working in a new, interdisciplinary field full of counterintuitive surprises.



Writing a textbook on complex systems is thus a difficult and important task. Claudius Gros's *Complex and Adaptive Dynamical Systems: A Primer* is a welcome addition to the literature. Although I have some criticisms, overall it is a solid text that complements other current books on the subject. Gros, who holds a chair in theoretical physics at the University of Frankfurt, has published research on complex networks, neural networks, and a range of topics in condensed-matter physics. His text is based on a graduate-level course he teaches at Frankfurt for students in the natural sciences, engineering, and neuroscience who have a basic knowledge of probability and ordinary and partial differential equations.

Gros's text is concise and focused. It does not attempt to survey the entire field of complex systems but instead zeros in on a narrow, albeit important, terrain that includes random Boolean networks, self-organized criticality, evolutionary dynamics, and synchronization phenomena. Gros has written a streamlined book that avoids the philosophizing and extrapolations that, in my view, too often accompany writing on complex systems. For the most part, he lets the mathematics and physics speak for themselves. The mathematical level, though, is fairly sophisticated; students who have had only an introductory class in differential equations or who have not studied statistical mechanics or dynamical systems will likely have difficulty with portions of the text. And at times I felt that the exposition was so lean that it may be hard for readers to discern common themes and ideas that tie together the book's topics.

The first two chapters of *Complex and Adaptive Dynamical Systems* are an overview of complex networks and dynamical systems. I found those chapters somewhat difficult to read. A lot of material is covered quickly, and several sections are unclear or contain minor misstatements. Subsequent chapters apply and extend the techniques introduced in the first two chapters, and I found them to be much more effective. A particular strength of the book is its emphasis on analytical techniques for studying complex systems. Although Gros includes some numerical results, he consistently uses analytic methods to build intuition and confirm the results of simulation. He gives a more central role to self-organized criticality than I think it deserves, and his final chapter on cognitive systems theory is more qualitative and speculative than the rest of the book. But on balance, Gros includes a good range of topics that will give readers a solid introduction to the portion of the field of complex systems most related to statistical mechanics and dynamical systems.

Each chapter includes 5–10 exercises, and an appendix gives partial solutions. Many of the problems strike me as lengthy and potentially quite challenging for students who lack a strong math or programming background. A few simpler problems would be a welcome addition. At the end of each chapter is a list of references. However, those references are not always tied to specific statements in the text. As a result, it is sometimes difficult to know where to turn to follow up particular ideas mentioned by Gros. On a related note, I wish the book did more to give readers a sense of current research questions concerning complex systems. While not a research monograph, Gros's book is for a fairly advanced and mathematically sophisticated audience that would benefit from an awareness of frontier topics in the field.

Instructors looking for a more general and slightly less demanding work may want to consider Nino Boccara's *Modeling Complex Systems* (Springer, 2004; see the review in PHYSICS TODAY, February 2005, page 65). Boccara's text gives little coverage to adaptive systems, so Gros's book complements it well. Those interested in an even less technical introduction to the subject may want to consider Gary William Flake's *The Computational Beauty of Nature* (MIT Press, 1998). An excellent, introduction to and perspective on the field of complex systems is Melanie Mitchell's *Complexity: A Guided Tour* (Oxford University Press, 2009), written for a general audience. Were I to teach a graduate-level introduction to complex systems, I would most likely choose Boccara's text. However, *Complex and Adaptive Dynamical Systems* could be a fine option for well-prepared students looking for a focused introduction to complex systems that emphasizes dynamical systems and analytic methods.

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