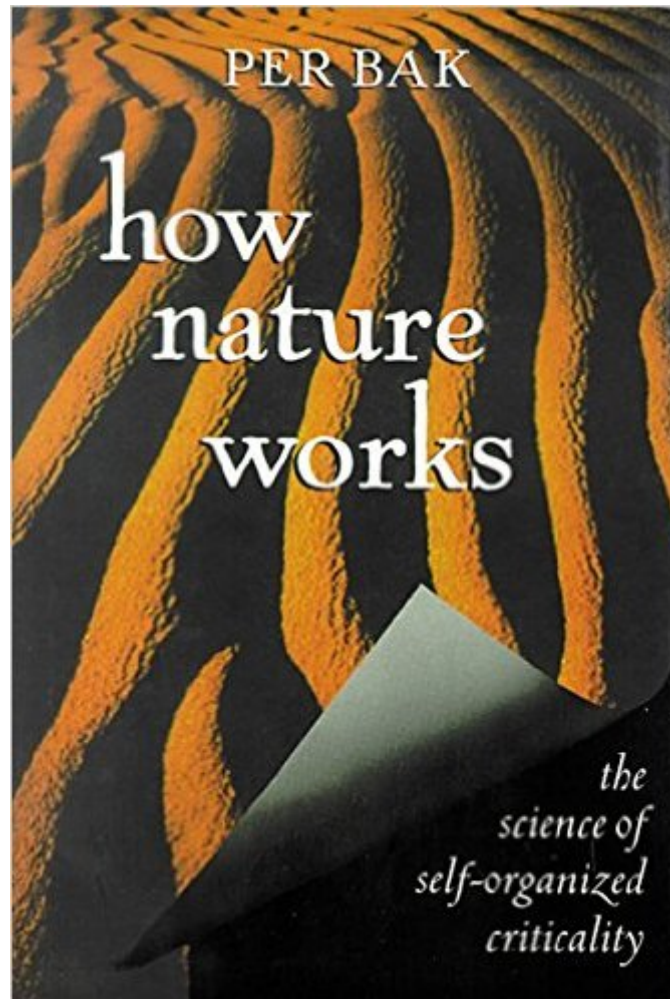


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# How Nature Works: The Science Of Self-organized Criticality



## Synopsis

Self-organized criticality, the spontaneous development of systems to a critical state, is the first general theory of complex systems with a firm mathematical basis. This theory describes how many seemingly desperate aspects of the world, from stock market crashes to mass extinctions, avalanches to solar flares, all share a set of simple, easily described properties."...a must read'...Bak writes with such ease and lucidity, and his ideas are so intriguing...essential reading for those interested in complex systems...it will reward a sufficiently skeptical reader." -NATURE"...presents the theory (self-organized criticality) in a form easily absorbed by the non-mathematically inclined reader." -BOSTON BOOK REVIEW"I picture Bak as a kind of scientific musketeer; flamboyant, touchy, full of swagger and ready to join every fray... His book is written with panache. The style is brisk, the content stimulating. I recommend it as a bracing experience." -NEW SCIENTIST

## Book Information

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## Customer Reviews

This is both a wonderful book and an awful one with two interleaved narratives. I've read the book cover to cover and some of the key chapters several times over. I've also replicated some of the key simulation results on a personal computer. Much to the credit of Per Bak's clear explanations designed to simplify he eminently succeeds at his task of making his point: complexity in nature can be simple to understand. Bak points out the existence of power laws in self-organized critical systems occurring in nature and he gives the reader the ability to model them using simple numerical methods. We could call them "back of the envelope calculations" if they were analytic. All

of this he manages to do without the need for the reader ever to go to the published literature. In the process of doing that, he does not completely strip off the plausibility of the models. In some sense it is quite a tour de force. So what could be awful about such a wonderful book? It would be a great world if those who make significant advances in science were magnanimous. While one narrative in Per Bak's book is all about self-organized criticality, the "other" narrative comes out all but too self-serving. Per Bak relishes in his moment in the limelight of science as he uses every bit of it as a platform to offer judgmental and patronizing opinions about every other field of science (including his own physics) and many colleagues he's worked with or benefited from the insight of... When convenient, reductionism is good but when not convenient, reductionism is vile. Big Science is mindless, except perhaps for this or perhaps for that... A lot of this "other narrative" really sounds like small talk around the departmental coffee pot with a few smirks and some wry smiles.

Per Bak's book *How Nature Works* is about the theory of self organizing criticality and its applicability to a variety of questions and problems in several sciences. It is an interesting and quick read for the most part. I have read other books on self organized criticality that were far less understandable and more limited in their scope of applicability. Although there were portions of Bak's work that were a little belabored-I found my interest in sand piles began to sag after the initial discussion, for instance-much of the rest of the book was enlightening. The discussion in Chapter 1 of the contrast between the clarity and simplicity of the laws of physics and the complexity and unpredictability of nature was particularly interesting as was the discussion of the difference between chaos and complexity. His explanation in Chapter 2 of the theory of self organized criticality and the history of its development is far clearer than I found Stuart Kauffman's to be. It might make a better starting place for anyone wishing to understand the theory a little better before going on to Kauffman's and other books on the subject. Essentially the theme of the book involves the self organization of much of the universe, from stars and volcanoes to traffic jams and economics, into critical states sustained as stable systems until they evolve through cascade events or what Bak calls avalanches (after his sand pile paradigm) or catastrophes. Bak explains that the system maintains itself along a critical line, above which chaos rules and nothing can be predicted and below which nothing happens so there is nothing to predict! Chapter 5 which deals with earthquakes and volcanic eruptions interested me in particular because of my own study of geology.

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