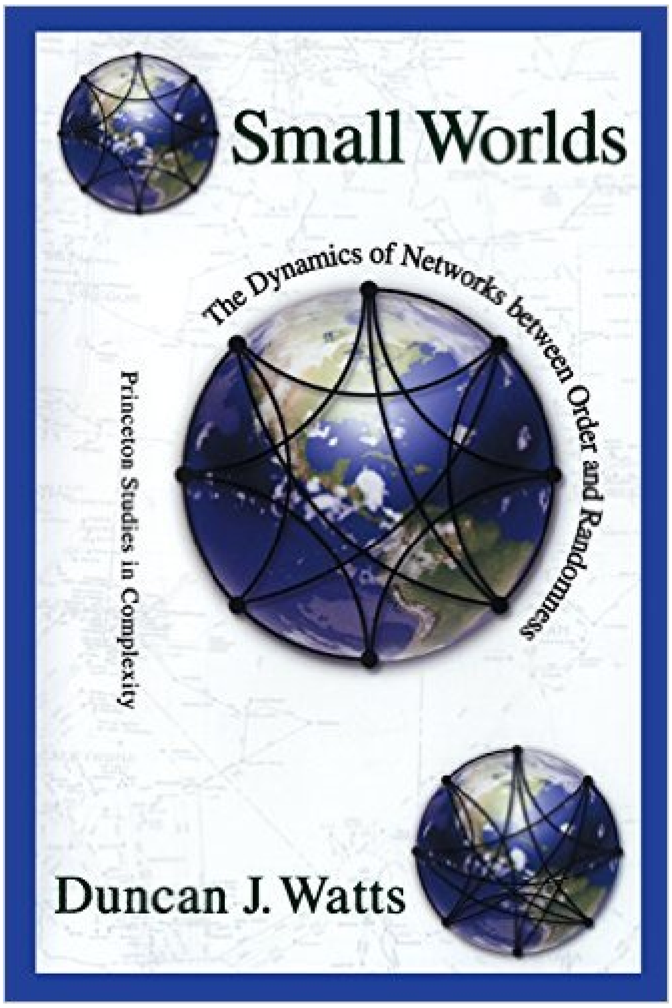
Small Worlds: The Dynamics Of Networks Between Order And Randomness (Princeton Studies In Complexity)



Synopsis

Everyone knows the small-world phenomenon: soon after meeting a stranger, we are surprised to discover that we have a mutual friend, or we are connected through a short chain of acquaintances. In his book, Duncan Watts uses this intriguing phenomenon--colloquially called "six degrees of separation"--as a prelude to a more general exploration: under what conditions can a small world arise in any kind of network?The networks of this story are everywhere: the brain is a network of neurons; organisations are people networks; the global economy is a network of national economies, which are networks of markets, which are in turn networks of interacting producers and consumers. Food webs, ecosystems, and the Internet can all be represented as networks, as can strategies for solving a problem, topics in a conversation, and even words in a language. Many of these networks, the author claims, will turn out to be small worlds.How do such networks matter? Simply put, local actions can have global consequences, and the relationship between local and global dynamics depends critically on the network's structure. Watts illustrates the subtleties of this relationship using a variety of simple models---the spread of infectious disease through a structured population; the evolution of cooperation in game theory; the computational capacity of cellular automata; and the sychronisation of coupled phase-oscillators.Watts's novel approach is relevant to many problems that deal with network connectivity and complex systems' behaviour in general: How do diseases (or rumours) spread through social networks? How does cooperation evolve in large groups? How do cascading failures propagate through large power grids, or financial systems? What is the most efficient architecture for an organisation, or for a communications network? This fascinating exploration will be fruitful in a remarkable variety of fields, including physics and mathematics, as well as sociology, economics, and biology.

Book Information

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Customer Reviews

I read the review in New Scientist, and liked the sound of this book. When it arrived I read the blurb on the back, and was further encouraged by the fact that a Sociology Professor was encouraging students to read it. I was therefore expecting a reasonably tough but rewarding read (my math is at undergraduate level and somewhat dated, but I do make an effort). Instead with the exception of a few pieces of commentary, particularly at the beginning, I found the book virtually impenetrable because of the denseness of the mathematical modelling techniques used. I suspect this is one strictly for the experts, and those with excellent post-graduate math skills.

Networks are since a couple of years object of intense research in several different disciplines. One reason therefore is certainly the outstanding article by Watts and Strogatz, Collective dynamics of small world networks, Nature, 393:440--442, 1998. Unfortunatelly, this book can not continue the high level of this article. Actually, it does not really provide much more information than the article itself. I would suggest to read the article cited above and either decide for another book or to look directly in the literature and read the origninal articles.To summarize, this book is not terribly weak, but one can clearly sees that it swims on the current ’complex networks’ wave without providing enough justification for its existence. Of course, if you do not have access to the original literature and just what to have a general overview of complex networks and what be done with them, you may consider buying this book.

This book is very hard for non-numerate individuals (like myself, a law student). I picked it up after reading Six Degrees: The Science of a Connected Age (Open Market Edition), hoping I would find longer - but equally accessible - explanations of those concepts that are sketched in the latter.Unfortunately, I didn’t. The book is essentially a presentation of the modelling techniques used by Prof. Watts in arriving to the theory of Small Worlds. A thorouhg understanding would require truly firm foundations in statistics, graph theory and topology. Without that, you’ll probably be able to understand at most twenty pages (out of 241).If you have read Six Degrees, you’ll still find some useful and still accessible discussion on multidimensional scaling, i.e. on the problem of measuring social distance, which Watts later discusses in Six Degrees with reference to the problem of search in networks. However, that's just about it.My two-star rating is by no means meant to criticise Prof. Watts's ideas, or the substantial contentions he makes in the book (very few of which I was able to understand from a mathematical point of view, due to my faulty background). Deserving two starts, instead, are the Editorial reviews, which are hugely misleading. This is not "aimed at a wide audience". Or, better, it is aimed at a wide audience of MATHEMATICIANS. It is a technical one, and that would need to be made explicit.

Mathematical level: Moderate; there's no calculus, and little high level math, but the book is quite mathematical in tone, and some of the arguments may be difficult to follow without a good "math sense". There are MANY equations and graphs.Good points: Watts covers an area that will interest those who deal with mathematical models of social networks e.g. models of disease-spread, especially HIV. It might, however, cover other things that can spread through networks as well. He presents analysis of graphs (or networks) that are neither random nor highly structured; and begins to examine ways that the degree of structure v. randomness can be measured.Bad points: There are more than the usual number of typos. The models presented are a "first step", only.

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