Small Worlds: the Dynamics of Networks between Order and Randomness

by Duncan J. Watts

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When Duncan J. Watts proposed his new idea to his advisor, Professor Steve Strogatz, he was completely afraid of being laughed out of Steve's office. His idea was just something ambiguously worthwhile, spanning several different disciplines, most of which both of them knew very little about. With encouragement and advice from Steve, graphs that combine structure with randomness were studied. The results of their work were published in Nature and the Cornell Ph.D. thesis of Watts. This book essentially came from Duncan's thesis.

The phenomena known as the "six degrees of separation" pervades our daily life. It means that two people who do not know each other can find a friendship chain of a distance of six people or less. Statistics show that most movie actors fall within a distance of four to Kevin Bacon of co-acting in a movie. This kind of bizarre correlation is referred to as the "small-world phenomenon". It is the analysis and formalization of this phenomenon that is the theme of this book.

The book is quite diverse and comprehensive in its scope while never forgetting its theme. It consists of ten chapters grouped into two parts. It ends with a bibliography of eight pages where one can find plenty of literature on this topic and related fields.

The main body of the book is divided as following: Part one deals with the structure of a graph, featuring a high clustering coefficient and a low characteristic path length, using several examples from the real world. It shows that a relatively tiny amount of random edge rewiring in a graph can cause a great reduction in the characteristic path length. Part two then tries to further study the dynamic evolution of the networks of "small worlds".

The chapters are presented in a logical sequence, starting with an introductory story about the six degrees of Kevin Bacon and an overview of the phenomenon. The overview provides a discussion of relational graphs, spatial graphs, transitions in them, and real networks. After the overview, the models and exploration of the dynamical behavior of small-world systems are examined in chapters three and four. Chapter three introduces graph-theoretic models, for example, the alpha- and beta-relational models, and identifies the new class of graphs: small-world graphs. Chapter four contains a heuristic construction and makes analytic approximations.

Examples of real small-world networks are studied in chapter five, while examples of small-world dynamical systems are examined in chapters six through nine of part two. If you do not have background knowledge on this topic, it is best to read this book from cover to cover following its organization logic.

However the book does not cover very recent results, as the preface might suggest. This is due to the author making further additions and refinements after the book was published in 1999. Further research is conducted at the Santa Fe Institute, and more information may be found on their web site.

There is a wealth of cleanly and carefully drawn figures and diagrams, solely from which you can easily enjoy the beauty of science. They are also very helpful in understanding the contents of the book.

All in all this is an excellent book. It was pure pleasure to read for this review. You will get to know and become familiar with this fantastic topic. You will also see how outstanding researchers are discovering something new based upon previous results. I strongly recommend people reading this book, including students, specialists, researchers and scientists.

Randomness.Â Nexus: small worlds and the groundbreaking science of networks. NEXUS Small Worlds and the Groundbreaking Science of Networks MARK BUCHANAN W. W. NORTON & COMPANY New York London Nexus: Small Worlds and the Groundbreaking Theory of Networks. Nexus: Small Worlds and the Groundbreaking Theory of Networks. A small-world network is a type of mathematical graph in which most nodes are not neighbors of one another, but the neighbors of any given node are likely to be neighbors of each other and most nodes can be reached from every other node by a small number of hops or steps. Specifically, a small-world network is defined to be a network where the typical distance L between two randomly chosen nodes (the number of steps required) grows proportionally to the logarithm of the number of nodes N in the 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. 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 tu networks of interacting producers and consumers. Food webs, ecosystems, and the Inteet 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 tu out to be small worlds. How do such networks matter? Simply put, local actions can have global consequences, and t