

Book Review by Lyn Lazar for 12/27/04

Title: "Linked: How Everything Is Connected to Everything Else and What It Means for Business, Science, and Everyday Life"

Authors: Albert-László Barabási

Publisher: Penguin Group

Copyright: 2002

Length: 238 pages

Price: \$14.00, paperback

Reading time: 6 hours

Reading rating: 7 (1 = very difficult; 10 = very easy)

Overall rating: 4 (1 = average; 4 = outstanding)

Subject Areas: networks, business, science

In his book, "Linked: How Everything Is Connected to Everything Else and What It Means for Business, Science, and Everyday Life," Albert-László Barabási (Emil T. Hofman Professor of Physics at Notre Dame) discusses the creation and examination of networks.

He first discusses the work of Leonhard Euler, a mathematician who created graph theory, the distant forerunner of network science today. In his proof solving a problem of seven bridges and four land masses, Euler replaced the landmasses with nodes and the bridges with links, and proved that a route which crosses each bridge only once does not exist if the intent is to return to the starting point.

Next, Barabási discusses work by Paul Erdős and Alfréd Rényi. After examining many different networks, they found most did not fit Euler's graph theory. Each node in a network was connected to any other node completely randomly, and therefore each node was expected to have a roughly equal number of links to other nodes. Networks which did not conform to graph theory led to the development of the random network model.

Inconsistencies were discovered in random networks because some nodes have far more links than would have been expected if links were distributed randomly. This lack of randomness was explored and became known as clustering. This discovery eased the examination of networks as they no longer were required to fit the random network model.

In 1998, Barabási, with PhD student Réka Albert, and postdoctoral associate Hawoong Jeong, embarked on a journey to discover the size of the Web and to discover the links which lead from page to page. Due to the enormous size of the entire Web, they first examined the domain of the University of Notre Dame, discovering approximately 300,000 documents. Examining the links between any two of these documents exhibited a great variability in the number of links. Some documents could be reached in a single click, but others took as many as twenty clicks to navigate to the document of interest. Working with increasingly larger and larger portions of the Web allowed the researchers to posit a formula for the average distance between documents, and found the result to be

nineteen clicks from one document to another document of particular interest. This is known as nineteen degrees of separation.

The Web can be compared to other networks such as the social network, the network present in a corporation, in a living organism, or in the way a disease spreads. The Kevin Bacon game was used as an example of the degrees of separation between those in a social network. The game became popular in the mid 1990's, and the idea was to connect Kevin Bacon to any other actor in as few connections as possible, and the average number of links required was about three. Was Kevin Bacon really the center of the Hollywood universe? Actually, Barabási's team determined that the average number of links for any actor to any other actor was also about three. The game illustrates well the links between nodes in a social network.

Barabási explains that although real networks are not as random as those envisioned by Erdős and Rényi, that randomness does have a role in the creations and sustainability of networks. Another key feature is that networks continue to grow, shaping the topology of the network in that growth. The future of networks involves the continuation of the mapping and exploration of networks, and the examination of their dynamics.

Lyn Lazar is an Assistant Professor of Computer Information Systems in the College of Business at Western Carolina University. For previously reviewed books, visit our Web site at www.wcu.edu/cob/bookreviews