Nexus Small Worlds and the Groundbreaking Theory of Networks

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Nexus Small Worlds and the Groundbreaking Theory of Networks

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Those of us who are primarily interested in what we might call the “soft” side of the Internet, the elements of it dealing with the Humanities or the Social Sciences, are occasionally brought up short by the reminder that the Internet at the last depends on both hardware and hard science. We try, therefore, at Interface to occasionally review books that while they might not appeal to a general audience, should be seen as important in understanding the Internet, even if they are a bit difficult to get through. Earlier, we reviewed one such book, Bernardo A. Huberman’s The Laws of the Web. [1] Now we take-up a related but seemingly more accessible work, Mark Buchanan’s Nexus Small Worlds and the Groundbreaking Theory of Networks.

It may be that our earlier reading of Huberman’s work made this book easier to understand, or it may be that Mark Buchanan, a highly published science writer, is simply more accustomed to speaking to a lay audience than the highly specialized Huberman. Whatever the cause may be Nexus seems more approachable.

Like Huberman, Buchanan is interpreting the findings of a rather arcane school of mathematics, network analysis, a part of the larger school of complexity theory. In order to follow Buchanan, we do need to grasp some basic concepts of network analysis. Fortunately, Buchanan presents this material in a manner that does not really require that we perform actual math, or even understand it at any basic level, but simply that we, too, like complexity theorists, learn to see some patterns that reoccur through many level of human and natural activities. Buchanan makes this process relatively easy as he leads us through the history of its development, beginning with the relatively recent interest in “Small World” problems such as the popular “Six Degrees of Kevin Bacon".
What we learn, as did the theorists who approached the many aspects of these problems, is that there are recurring patterns, whether in natural systems, such as the organization of the human brain, or the patterns of interactions in economic behavior (“the Rich Get Richer”) or in the World Wide Web. These patterns are usually best described by “power-laws” which to mathematicians means the relationships between elements in a system which can be represented graphically (such as the number of nodes in particular sites on the World Wide Web) and some other attribute of the systems, such as the level of activity at those sites. A power-law, then, in this example expresses the relationship between the number of nodes and the relative traffic. These relationships are not easy to spot at first glance, because they are never simply arithmetic ones; that is, doubling the number of nodes does not simply double the amount of traffic. Nor is the relationship between nodes and traffic, however expressed, always constant. That is, there is a different relationship between sites with numerous nodes and their traffic patterns and those with lesser nodes and their traffic patterns. [2] But nonetheless, when viewed graphically a consistent pattern reveals itself.

The exciting thing about these relationships, however elusive and difficult to explain they may be, is that they are found throughout nature and in many aspects of human activity. The concept, then, of a power-law and a “Small World” will lead us to see regularities where earlier we saw only chaos. It is particularly exciting, too, to see that these regularities often have great explanatory power.

While the entire book is interesting, as Buchanan shows us regularities in everything from the nervous system of nematodes to investment activities, only part of it relates directly to the World Wide Web. That part, however, is very useful.

We learn that there exist at least two fundamental sorts of networks: “egalitarian” (ones with relative regularity between all of the elements that make them up, such as an Internet site in which all pages attract pretty much the same level of traffic) and “aristocratic” ones (in which some sites attract a great deal of the traffic and others very little). The World Wide Web itself can be seen as a vast “aristocratic” network or Small World, though it contains many “egalitarian” sites.

There are some weaknesses in the book. Buchanan’s enthusiasm for regularities leads him down some strange paths; for example, he believes that there are even laws to be found in human history. This position is probably an inevitable one for a science writer like Buchanan, but to an historian such as myself, it is one marked by the wreckages of earlier positivist attempts to reduce human behavior to conformity with natural laws.

Not only is the theoretical side of this work interesting, as it broadens our view of many phenomena, but to those who build or maintain systems such as web sites, it is immediately useful. Just as egalitarian or aristocratic systems have certain advantages, so do they have certain disadvantages. An aristocratic site will probably attract continually larger groups of visitors, but it is also very much easier to bring down than an egalitarian sites. These and other insights
make *Nexus* well worth reading, though some work is required to do so.

Jeffrey Barlow
Editor, *Interface*.


[2] The best explanation of these relationships comes at pp 83-84 in Buchanan, though they are referred to throughout the book and hence frequently reinforced to the point where even a math-handicapped historian eventually comes to believe that he understands them.

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ONE THOUGHT ON "NEXUS SMALL WORLDS AND THE GROUNDBREAKING THEORY OF NETWORKS"

Emelia Enriguez
on January 30, 2014 at 6:16 PM said:

Great