Some Problems that Arise when Taking a Network Science Approach to Informatics, and Some Possible Workarounds

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ABSTRACT

Informatics is a professional practice that involves using Automated Information and Communication Technologies (AICTs) to solve problems. If defined in this manner, it follows that a major part of the knowledge base on which the practice of Informatics depends is studies of AICTs in use. Since AICTs are generally used with the context of social as well as other forms of networking, it seems reasonable that the dynamics of such networking will influence the correlates of AICT use. If network science can help us understand these dynamics, it can make a contribution to Informatics.

There are some aspects of network science that may hinder its value to parts of Informatics, however. In this paper, we offer some preliminary specifications of kinds of epistemological problems that can arise when one attempts to use 1) the tools developed in Network Science and 2) its results—e.g., limiting analysis to only one perspective—to understand what happens when AICTed systems are used. We also make some suggestions about ways to use network science tools and perspectives in ways that may allow us to work around these problems. We are aware of the benefits of network analysis in many cases. What we oppose is the way these approaches can be misappropriated.

When used, the tools developed to support network science direct attention to the nodes and links that are a part of interaction among elements. Focusing on nodes and links helps us see similarities among diverse networkings, but it also has a down side. This focus means abstracting networking elements from their cultural, economic or political contexts, in order to see dynamics more clearly. Further, computational network analysis usually starts with prior specification of the elements of a network: its nodes (individuals or actors) and the relations (or ties) between nodes. When relations and nodes are predefined—e.g. routers and physical connections connecting them—a representation is formed using the identified nodes and relations, usually in the form of a connection matrix. This matrix has columns and rows as nodes, and the intersection points as relations. This representation usually doesn't carry more information than a numerical value corresponding to the perceived strength of the relationship. In essence, this means that doing network analysis not only strips away other characteristics (or attributes) of the individual nodes in the analysis. It is also at great risk of missing networking dynamics which may be part of the actual interaction but which were not, as it were, designed into the predefined, pre-conceptualized dynamics of the system.

Were one to have identified either interesting information or patterns before the initial abstractions, the stripped information/patterns must somehow be reinserted to allows the most meaningfully possible inferences. Were interesting information or patterns not perceived before abstracting was performed, it is unlikely that they will survive the simplification. Were they not to, they would be lost.

Phillip Howard's *network ethnography* approach (2002) offers some hope for coming to terms with the problems of taking a networking approach to comparative qualitative study in technologically more complex (AICTed) communities. In the paper, we explore the benefits and limits of his approach. This allows us to specify some of our more general analytic concerns about the value of the network science approach to Informatics.

The project of network science is, in general terms, to identify laws—to articulate statements that describe the invariant properties and behaviors of network irrespective of their particular kind—and to state them if possible in mathematical language. It is the search for networking universals that compels abstracting from the particular features of any particular network before analysis. To the extent that the dynamics of any particular example or kind of networking follows from its contexts and/or their interaction—that is, are overdetermined—the abstraction demanded by the network science approach should generally take us further from rather than closer to understanding these particular dynamics. The fate of an earlier attempt to develop social studies of networks, that of British Africanist anthropologists like Clyde Mitchell, helps illuminate what is put at risk in the effort to take a universalistic approach to the study of some social networking.

Further, many network science tools were developed to help cope with large, inchoate assemblages of data. There are, however, many forms of social interaction whose dynamics can be perceived directly, as by ethnographic participant observation of/in them. Does this mean that such dynamics are in effect not a part of network science, that network studies of smaller and the network science performed on larger data sets are orthogonal? Mark Bedau's approach to the study of cultural evolution will be used to highlight some of the problems that arise here. We conclude by indicating what all three cases suggest about how a rapproachement between Network Science and Network Studies might be achieved.

Categories and Subject Descriptors

D.3.3 [**Programming Languages**]: Language Contructs and Features – *abstract data types, polymorphism, control structures.* This is just an example, please use the correct category and subject descriptors for your submission. *To find the list of ACM's categories & descriptors, see:* http://www.acm.org/class/1998/

General Terms

Theory

Keywords