

Applications of Social Networks and Economic Sociology to Information Systems

Donald Steiny

Department of Information Processing Science

University of Oulu

22 April 2008

Abstract

This thesis talks about several diverse topics under the sociological viewpoint of economic sociology especially that of Harrison White. It looks at innovation, diffusion of innovation, persuasion, social networks, network awareness, roles and other special positions in network. It ties together observations from sociology, social psychology, personality psychology, marketing, information systems, and organizational science under a single theoretical model and proposes ways that it might be applied to several areas of information systems.

Table of Contents

Introduction	3
Background	3
Relational vs. Attributional Classifications.....	3
Functionalism.....	5
Economic Sociology	6
Networks.....	7
Methods and Literature Review	9
Innovation, Productivity and Network Awareness	10
Network Awareness in Information Systems	14
Contributions	16
Conclusion and Discussion.....	17
References	18

Introduction

The thesis applies the conceptual models of economic sociology to the domain of information systems. According to a basic textbook definition of an Information System, “an information system in an organization provides processes and information useful to its members and clients.” (Avison and Fitzgerald 2003, p. 1). The use of personal computers, cellular technology and embedded devices has expanded the domain of information systems into the realm of personal use. It is more useful to think of it as any system that enhances human performance, more in the lines of the thinking of Doug Engelbart (Engelbart 1962). Some scientists are considering “persuasive technology” which, by the definition of the pioneer of the field, involves a relationship between some piece of technology and a human (Fogg 2003; Oinas-Kukkonen and Harjuma 2008). Information systems research can be based on comprehensive social theories such as those of Anthony Giddens (Poole and McPhee 1983; Lyytinen and Hirschheim 1989; DeSanctis and Poole 1994; Iivari and Lyytinen 1998) or they can be focused on the level of the interface as in the persuasive case. Though there are many variants of social theories to choose from the majority of social theories in information systems are “functionalist.” Economic sociology was developed in the late 60’s and 70’s to address some of the problems of functionalism and it has become the dominant paradigm in sociology and anthropology (Granovetter 1990). This paper brings together some results from different areas of research including marketing, social psychology, and network sociology using economic (or network) sociology and proposes a new theory that might be useful for improving the results of information system implementations.

Background

The thesis relies heavily on the sociology of Harrison White and his students. White addresses fundamental questions like “what is an actor” and his sociology goes from the level of an individual to society in general, what he calls “the middle range” between macro and micro sociology. In addition White, his students and his student’s students have studied production, production markets (White 1981), exchange markets (Granovetter 1985; Granovetter and Swedberg 1992; Granovetter 2005), organizations (Mizruchi and Potts 1998; Mizruchi and Stearns 2001), regions (Romo 1995), **social movements** (Baldassarri and Bearman 2006) and even the pecking order of chickens and fish (Chase 1982; Chase 1985; Chase, Tovey et al. 2002). **Though** there is significant work on computational models of organizations, innovation diffusion and other social processes by another of his students (Carley 2000; Lin, Zhao et al. 2006), his conceptual framework has not been applied to information systems. His theory includes individual actors up through organizations to human society in general and since one of the key parts of his models is networks, it is especially well suited to modern organizations.

Relational vs. Attributional Classifications

A foundational aspect of White’s work is classifying the world by relations instead of attributes. Either way of classifying is valuable but relational classifications imply networks and by using relational classifications, we can then discuss what we have classified in terms of networks.

The most common way to classify things is by their attributes, qualities or essences. In some ways it is too obvious to question, say men and women. We are especially likely to do this with each other. Over the years there have been many schemes to classify human beings by attributes. Many of them are still widely used. Some examples are: race, intelligence, income, sexual preference, location, and personality. For instance, one of the Nobel Prize winning discoverers of the double helix of DNA, James Watson, created a hubbub when he said that the problems in Africa were intractable because blacks were less intelligent than whites (Times 2007). Though Watson later said he was misunderstood, his statement made sense to many because intelligence is, like race, seen as an attribute or quality, something that is part of what someone is. But looking at either race or intelligence carefully show countless alternate explanations (Suzuki and Aronson 2005). Ultimately, some are in the ironic situation of explaining "intelligence" in terms of "race," when both are social constructs that may vary from place to place.

The "relational view" (Wellman 1988) can be explained by looking at the drawing in Figure #1, "Boys and Girls." The white circles represent boys and the dark ones girls. The lines between them mean they know each other and talk to each other. This is a tiny example, just 5 individuals but it is meant to illustrate a point. If we divide the group based on the attribute "boy" or "girl," we will get the sets [A, B, C] and [D, E]. But A and C do not talk to each other and D and E do not talk to each other so from a relational point of view the sets [A, B, D] and [C, E] are more natural. The attribute view also misses the special nature of [B], who is in both groups. Besides the different logical division there is another point to the relational view which is that if any node or edge is removed the relationships of the entire graph change. Removing [B] would split the graph in two. Removing the link between [B, D] would increase the distance a message would need to travel to [D] and put [A] in the middle. This is the role of a "broker," who can control the communication between [A] and [D] and is a powerful role (Burt 1992). Removing a girl node or boy node would have no effect on the "girliness" or "boyiness" of the other nodes. Attribute based categories assume independence, relational categories assume interdependence.

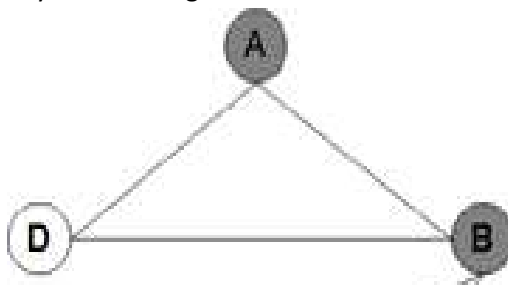
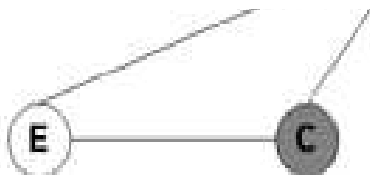


Figure 1 - Boys and Girls



Suppose that we are trying to understand how a society or an organization works and we are told that society is divided into boys and girls, or blacks and whites, or any other division. The relationship between the set of relations and the set of categories may be critical for understanding the behavior being studied. Sociologist Charles Tilly defines a boundary one group having one set of relations among themselves, another with different relations among themselves and still a different relations any member of one group and a member of the other (Tilly 2005). People are glued together by relationships instead of similarity of attributes.

In practice, the drawing in Figure #1 would most likely be divided into boys and girls, in that, girls are more likely to hang with girls and boys with boys. But something else could be going on, the top group could live in town and the other in the country. Just as the people could have

multiple qualities; they can also have multiple relations, “friend of,” “sister of,” and so on; so relations can be indefinitely rich in descriptive power.

Functionalism

Creating categories is often a difficult business and there is often more than one way to categorize the world around us. The biologist Stephen J. Gould wrote an essay on “the Panglossian paradigm” which is a discussion in the context of biology that applies to the social world as well. It is a reference to Dr. Pangloss in Voltaire’s *Candide* who lived in “the best of all possible worlds” While he is talking about one view of evolution, his argument about reasoning about causes from categories derived from current observations has wide ranging application.

An organism is atomized into 'traits' and these traits are explained as structures optimally designed by natural selection for their functions. ... Organisms are integrated entities, not collections of discrete objects. Our favourite example involves the human chin If we regard the chin as a 'thing', rather than as a product of interaction between two growth fields (alveolar and mandibular), then we are led to an interpretation of its origin (recapitulatory) exactly opposite to the one now generally favoured (neotenic).

... the rejection of one adaptive story usually leads to its replacement by another, rather than to a suspicion that a different kind of explanation might be required. Since the range of adaptive stories is as wide as our minds are fertile, new stories can always be postulated. And if a story is not immediately available, one can always plead temporary ignorance and trust that it will be forthcoming (Gould and Lewontin 1979,p. 151)

This relates social theories called “functionalist.” Some of the names of sociologists associated with this theory are Parsons, Merton and Lazerfeld. The following is a description of functionalism:

The logic of the functional system contains 5 steps. First the relevant components of the system must be identified including the boundary so it is possible to distinguish the system from its environment. Second, the relevant parts of the environment—those that affect and influence the operation of the system—are identified. Third, a trait, attribute or some other property of the system that is essential for continued operation of the system, that is, for it to continue functioning. Fourth, the different values that the trait can assume must be specified along with the range in which the traits must be kept in order for the system to survive. It is assumed that if the values of the trait do not stay within the acceptable range, the system will cease to function. Finally, the relations among the parts must be described to show how their collective operations keep the traits within the range required to sustain the system. (Monge and Contractor 2003, p. 51)

As you can see, it is a template for the Panglossian view, with all the difficulties described. More critically, once the organism, organization or society has been broken down into “traits” and the relationship between the traits defined, then the definition is static. There is no room

for new traits or new relationships. This same type of view can be used of organizations where the desired trait is some “magic number” like profits.

Functionalism is the dominant paradigm in information systems. This may have been an accident of history. The time when the strongest period of borrowing from sociology was at the time functionalism was strongest and as information systems was forming. At the same time many sciences were thinking of humans as “symbol manipulating machines,” from the cognitive psychology of Ulrich Neisser to the linguistics of Noam Chomsky. Talcott Parsons formed the *Department of Social Relations* at Harvard to unify sociology, psychology and anthropology and develop his unified theory of society. Parson conceived of society as organized interrelating parts with inputs and outputs much the same as computers. It is no surprise that as computers became ubiquitous, that the metaphor of society as a computer developed in parallel with the metaphors of the brain as a computer, something we now realize is far off the mark.

Not only did the functionalists make Dr. Pangloss’ error above, thinking that things developed the way they did because they served a function, but they compounded this by coming up with an overall reason for that, which is values, beliefs and rational action. This created grave difficulties for its empirical basis, because even though the forerunners of functionalism like Durkheim had showed that social facts were real with his penetrating study of suicide, the lack of specificity has made it difficult to determine cause and effect.

When forming the Department of Social Relations at Harvard, Parsons left economics independent of his program of unification of the social sciences. Since the “battle of methods” in the 1920s was won by the neo-classical economists, economics had become a field almost parallel to human society. Certainly the predictions and models of economists at the micro level are wanting. To become a legitimate science like physics they had to strip the field of history or context and reduce human behavior to aggregates of countless rational binary choices. Like functionalism it rests, in part, on the idea of a “rational person” who makes choices by some laws or knowledge that is assumed but not open to scrutiny.

Economic Sociology

Economic sociology or “network sociology” came into being partially as a response to functionalism. It sees economic action as taking place in networks of social relations. It does not take society as a unified, seamless whole:

[T]here is no tidy atom and no clear-cut world, only complex striations, long strings that repeat as in a polymer goo”. Although, there are no neat systems and subsystems, the strings do repeat and there is discoverable order at different scales (Steiny 2007)

The new sociology was partially as a reaction to functionalism and partially because of the ideas of Harrison White and his students (Schwartz and White 1966; Mullins 1973; Azarian 2005). The term “economic sociology” was invented in 1985 and the key article was Mark Granovetter’s “Economic Action and Social Structure: The Problem of Embeddedness” which appeared in the November 1985 issue of *American Journal of Sociology* (Swedberg 1997). Granovetter discussed ways both rational actors and social structure could be taken into account and proposed an alternative to the behaviorist, atomic actors of neo-classical economic theory. Part of what the economic sociologists did is to study institutions as social constructions

(Granovetter 1992) which means they exist independently and economic action does not create them, but operates within their constraints (Granovetter 1985).

A recent book on the history of business schools, *From Higher Aims to Hired Hands* by Rakesh Khurana, chronicles the change in the meaning of business. There were a number of factors that caused this. One is that neo-classical economics crowded out institutional economics. Another was efforts to make management a “science” and legitimate profession. Now we think of it differently than it was thought of even in the 1960’s (Khurana 2007). That means that if we were to dissect the animal and analyze the functions that created its success, it would look different than it did 40 years ago. Khurana suggests that the attempts to rationalize business, to turn it in to clear functions and tasks stripped it of relationship to stakeholders and created the problems we see today.

What is especially important about Khurana’s study is not so much the efforts that were made to rationalize business and turn business and management into a science, but the more subtle shift in what is taken for granted. Now we don’t question that the purpose of a business is to make profits for its shareholders, of course those profits are defined by standard accounting practices, how else could it be? But what is taken for granted by society at large can be seen as social construction by scientists (Granovetter 1992). A key metaphor to talk about social constructions is networks.

Networks

In information systems there are many references to networks, those of work flow, supply chains, value networks and more. These are all valid. White talks of ties as stories that we tell about action (Steiny 2007). The potential for difficulties arises when the set of stories we have to explain actions are not longer useful. Since, as White says, networks are phenomenological, the networks we see are real to us, how do we get underneath reality and learn to make better choices? The history of information systems, back to the days of bookkeepers sitting in dark offices with green eyeshades to the modern ERP systems have always had the subtext of keeping us from deluding ourselves. We really don’t know how profitable a company is until someone does the books.

The concept of a network is not a uniform one. In one view, networks are simple flows of something from one point to another. This something could be information, knowledge, money or much more. There is a great deal of research that is done on networks as networks. For instance, the work of Barabási (Barabási 2002) and Watts (Newman, Watts et al. 2002; Dodds, Muhamad et al. 2003; Watts 2004; Watts and Dodds 2007). This type of research treats nodes as actors that choose to attach or not to attach, as infections that infect or do not infect and other situations where the networks is based on dyadic relations between the actors. In a sense, the flow is more that of links, where a link of one node (a spread of disease, a Web link) to another is the outcome. In this sort of network, once the connection is established, the path is sometimes thought of as allowing for communication between the nodes. The attributes of the nodes become important and users search through the networks looking for things like “knowledge” or “jobs,” which are part of a node. Nodes can be connected by some exchange between them. The most obvious is the exchange of money and goods; like trade networks or supply chains. Still another is networks where something flows like water through a pipe. Those

networks can be things like production lines in an organization for a one way flow, or “knowledge” which is seen as a material substance that flows through networks. In this view of networks the individual nodes act more like pipe fittings that can restrict or allow the flow. White takes a broader view of networks and points out of the term “network” that “... it does have misleading, mechanistic overtones. Terminology in social science applications remains loose and unstandardized, ..” (White 2008, p. 26). He is not calling for standardization, but looking at networks not as only things, but as a way of looking at things.

Part of the problem is the conceptualization of a network as two dimensional. This can be useful as a snapshot, a metaphor and a way of reducing complexity, but it also can be misleading. A network is a pattern of relationships. A relation can be “friend of” or “follower of” or “advisor to” or “husband of” or countless other things. The limit is our imaginations. Certainly “buys from” or “sells to” are relations and can account for exchange networks, “communicates with” can account for communications network and “is linked to” or “infected by” are relationships as well. The relations are not mutually exclusive, so we can be “friend of” and “father to” and “employee of” all different networks. At the very least any network is three dimensional because it changes over time. A network with one node more or less is not the same network. One exciting promise of the new data that is becoming available through IM, e-mail, social networking, cell networks and so on is that we will be able to take slices one after the other in real time and see the networks in three dimensions.

What is critical is that we are all part of multiple relations and usually when we talk of a “network” we are looking at the network of a single relation, or as, in what are called Granovetter ties, we are aggregating multiple relations in to a single “tie.” This has been useful in reducing the complexity of networks and been valuable, but it can be logically inconsistent. Someone who is a member of the network “is leader of” and the network “is disliked by” is probably going to have different experiences “is leader of” and “is liked by.” Depending on the network or combination of networks that are active at any time our description of the node will be different and an individual’s position in each network will be different. In one she may be high status and high betweenness but neither in another. Network analysis has increasingly taken the idea of multiple networks into account, with White a leader in this area. The idea of multiple networks is critical to his theories.

Following through the idea of multiple networks any individual will have multiple roles and multiple identities. Part of how we are seen is because of our role, and if we have multiple roles that we switch between, the idea of an atomic actor making rational decisions at some singular point in space breaks down.

White points out that:

The difficulty of the construct “individual as person” is shown by its being shunted aside from the center of activity in each social science separately. The construct, although indispensable to current theory, is opaque to research from that theory. Current economics proclaims the individual as foundation construct, but economics assiduously avoids any responsibility for understanding and predicting, pointing instead to psychology. Psychology as a scientific discipline distains “the person.” The active science today is rooted in cognitive aspects and emphasizes the “wet,”

the biological substrate of neural cell physiology, or else emphasizes perception and development and other correlates to the ecological environment. Deference to social psychology is low just because it gives some grudging attention to the “person” construct as pollution. This paradox, the shunning of a construct which is central in the axioms of current social science, suggests that social action is induced before actors, who derive from the action and need not be persons. (White 1992, p. 3)

The same issue that was mentioned earlier in the founding of economic sociology is being addressed here; that a “person” is taken as an atomic unit by social science. A “person” makes a rational choice to decide if he or she will buy something, but we do not know it until the choice has been made, her preferences are revealed by her action. The choice exists because of the act and the actor is created by the act.

What is an actor? Is an innovator an actor? Is a leader an actor? We tend to think that actions of actors cause things, the actions of innovator cause innovations, the actions of leaders cause all manner of things. But, what or who is this person that is doing it? In the case of innovation, it is worthwhile to note that nothing is an innovation, by definition, until it is adopted. After people start using it, it becomes obvious to us that some “great man,” Einstein, Edison, Ford or whoever had a great idea that turned into an innovation. But careful study of the histories of innovation shows that there is a long process of negotiation, luck and retelling of history that creates our view of events (Hargadon and Douglas 2001; Hargadon 2003). An especially good study of this type is the invention of the “opiate receptor” which shows how multiple teams working on similar things inform each other and that the “breakthrough” was a matter of the press and not any singular discovery (Cozzens 1989). Likewise in persuasion there must be a persuader, an actor that persuades. As with economic choice, the action creates the actor. There can be no persuader or persuaded until someone acts. The actions create the actors.

Roles can be actors. The idea of a “role” is crucial to sociology in general and especially to White’s work. His books, *Anatomy of Kinship* and *Chains of Opportunity* and his later work on structural equivalence and blockmodels create a basis to describe roles in terms of networks. A role is a slot in society that comes with assumptions about how the person that is occupying it is to behave and how one should behave towards the occupant of the role. Since the role is socially constructed the choices the occupant of the role has are limited. We can switch between roles, but the roles themselves are set by social conventions. If a judge does not act judgely she loses credibility (Berger and Luckmann 1966). What White and his colleagues did was to create a mathematical foundation for social construction of roles, and later persons and organizations. One of the goals of this research is to apply this to information systems.

Methods and Literature Review

The research used a conceptual analytic framework to create new theory about several issues that are studied in information systems research. It is critical to all theories that there is evidence. The thesis work reinterprets evidence from a number of fields including social psychology, sociology and information systems. It is a meta analysis putting existing results into a new framework and developing theory based on that.

To do this required an extensive literature review in all three fields. One source of references was the bibliography of *Identity and Control* by Harrison White, the most comprehensive review of the types of sociology the thesis is using as a conceptual framework. White draws from a number of sources outside of sociology. Placing White's concepts into Burrell and Morgan's (Burrell and Morgon 1979) framework is somewhat difficult because network analysis has a strong empirical basis (Freeman 2004) but some of his ideas have not yet been tested. White proposes several of theoretical constructs based on his reinterpretation of case studies rather than original research. White also has strong elements of social construction and critical theory in his work. The thesis adopts or at least considers these constructs in its research. Social psychology literature was reviewed both for general overlap and how it specifically relates to persuasion, influence and other relevant concepts. Economic literature was reviewed to tie it to economic sociology and innovation. Relevant information systems literature was reviewed as well.

Innovation, Productivity and Network Awareness

Innovation research has a number of distinct threads, the diffusion of innovation work and work on the source of innovation. This paper will provide some insight into how these two threads can be joined.

There are many definitions of innovation. In one sense every time someone solves a problem it is "innovation." This is important and valuable and in the broadest sense of an "invention someone uses" it is an innovation. However, in most cases it cannot be used elsewhere. If analysts use their background, experience and skills to solve problems in ways that are not "off-the-shelf," some might call it innovation. Following that logic, someone that figures out a way to cut down the time it takes them to do her shopping is being innovative and innovation is synonymous with "solving problems" or "doing things more efficiently." However, many solutions to problems are idiosyncratic and they will work in one circumstance only. I adopt a narrower definition of innovation in that it has to be able to widely diffuse and produce sustained benefit to the adopters.

If an innovation is an invention that is adopted, then its spread through networks is a prerequisite for it to change status from invention to innovation. There are many great ideas discussed or even tried that do not gain the status of innovation because they remain local. When we study innovation, we are always sampling on the dependent variable. Whatever criteria we use, patents, newspaper stories, or whatever, we define the set we use as our sample. It is not that different from studying human height by sampling only people that are 1.8 meters tall. We cannot even really talk about proto innovations, there is no real word for them and no way to identify them or find them. Innovations are an example of the same observation White makes above about people, action creates the actor.

Many organizations have innovation as a top priority. Some economists say that innovation is the engine that drives economic growth. A research result of this thesis is

... that being aware of the properties and structure of networks can lead to better or worse performance in terms of innovation and productivity by individuals,

organizations and regions, and suggest how this information can be used for further research and design of information systems. (Steiny and Oinas-Kukkonen 2007, p. 414)

It is more fruitful to look at locations in the network than at individuals as sources of innovation

... it is increasingly useful to think ... in terms of networks: webs of connections that link people, organizations[sic] and society together. These networks provide resources and information. They also have the potential to spread information from any node of the network to other parts of the network (Steiny and Oinas-Kukkonen 2007)

Innovation results from the intersection and overlap of different networks. Network studies show that even a two dimensional snapshot of networks gives us a clue about what could be going on. A key concept is that of a person who is bridging between different groups, *tertius iungens*, "the third who joins." The evidence shows that innovation comes from ideas being borrowed or somehow created from two different social networks joining. They can be groups that have not interacted or groups that have interacted before interacting in different ways (Steiny and Oinas-Kukkonen 2007). This leads us to the idea that there are certain people that, if we find them, are going to be the sources of innovation. However, as research has shown, it does not really work that way. What else could be going on?

If we go back to the discussion of the adaptive paradigm above and recall that we can only spot innovations after they have happened, it becomes worthwhile to recall the comment by White above that "action causes actors." How can we gain a perspective on an organization or a region that will allow us to be more "innovative?" How can we know if it is the attributes of special individuals, who may not, as originally thought, have "great ideas" but rather the ability to borrow ideas from one group and bring them into another, or if it is purely the result of random occurrences that make the individual salient? It seems without question that, as Keith Sawyer says, "we cannot explain business creativity by looking inside the heads of the smartest employees." Should we, instead, be looking in the heads of our most networked employees? It is not straightforward, because as we discovered in Obstfeld's study, focus was required as well to push the idea through until it was used. But again, we can see that that happens, but we only see it when it was a success. It is easy to imagine causes, not unlike the cause of the chin in Gould's example above. Is the ability to innovate locked in the "personalities" of some individuals, a gift they are born with, or is it possible to make strategic choices that lead to more innovation? Certainly the relative histories of Silicon Valley and Boston give weight to strategic choices as a possibility (Saxenian 1996; Fleming 2004).

One aspect of this is the relationship between *the tertius iungens* role and the idea found in diffusion of innovation literature of exceptionally persuasive people called "thought leaders" or "influentials" (Katz and Lazarsfeld 1955; Valente 2006). There is thought to be a "two step" process whereby certain people in a community became aware of innovations and influenced the others to adopt them (Katz and Lazarsfeld 1955). There is a great deal of empirical evidence that this is true (Valente and Pumpuang 2007). However, a recent article by Duncan Watts called this into question by logically following different possible ways that innovation could

diffuse through network. He shows that the influentials hypothesis would not account for many of the mass market phenomena (like Harry Potter). Watts proposed that a better model would be “easily influenced.”(Watts and Dodds 2007). As we will see, the ideas are not contradictory.

In the first concept, that of *tertius iungens*, the individual is apparently deliberately joining the two groups. In the second, persuasive people are borrowing ideas from somewhere, the media or the like, and then introducing them to their social groups. Another place where these network hubs have become salient is found in psychology and consumer marketing, in the personality construct of “self-monitoring,” which is also highly correlated to these hubs (Mehra, Kilduff et al. 2001). Self-monitoring is evaluated on a single dimension, from high to low. High self-monitors tend to present different selves in different situations, look to the others to see how to act in unknown social situations, go along with the group and keep social groups segregated. People that are low on the self-monitoring scale prefer to present a consistent face based on internalized norms and values. The high self-monitoring role seems to be people that are easy to influence, but they are in the same network position as the influentials.

This is a recipe for bridging, recalling that networks are not two dimensional and the different networks reflect different views of the world, a person that would bridge between them would have to have these exact skills. White’s sociology is skeptical of the idea of personality and in the view taken in this thesis that what we consider to be attributes might be consequences of social position, the “high self-monitoring” personality might be a consequence of where they are as well as personal characteristics. None of the other personality measures in the Big Five or Myers-Briggs correlate to network position. Rather than keeping the groups separate as the psychologists believe it might be that the social groups keep themselves segregated, something common enough. It is stating the same fact from a different viewpoint and winding up with different causes. The psychological viewpoint leads back to theories of “great men,” which we know are wrong, the sociological viewpoint points us to places in the world where we can look to try and understand what is going on.

White offers a perspective in *Identity and Control* that can help the divergent perspectives converge. He talks of the idea of “style.” His description of one aspect of it is close to the idea of “self-monitoring.” He resolves the issue of persons as atomic individuals by talking of persons as “styles.” A style is habitus, the unspoken assumptions that are our current place in the networks at this moment. Identity comes from mismatch and style is a source of identity. For instance, wearing an earring and spiked red hair might be appropriate and even give high status in some networks, but in others it would seem rebellious or immature. If everyone in a group dresses in a way that it is not mainstream, within that group it is the norm, but in another group it gives that person an identity because of the contrast and differences from the norms of the group. White thinks of this mismatch between what is the baseline for the particular network and the person as the source of identity. It is not so much that we have different identities in different network as that because we are in so many different networks we have different identities, it is the mismatch between two different networks that give us identity. The idea of style is partially that which we bring to different networks and that bundle is a person. Style is interweaves in networks; it interacts with them but is not part of them.

... the charismatic is a person purged of style, a manifestation of unpredictability in profiles of switchings. This fits with Weber’s conception of charisma as an innovative

force that challenges everything traditional. Note, however, that being purged of style does not mean the absence of style. The charismatic person stands above styles and integrates them in unpredictable patterns, a very strategic perspective indeed (White 2008, p. 130).

White's charismatic is similar to the self-monitoring concept. Style is one's sense of what is going on. Different social groups have different rules for how to behave, what's cool and so on. Often they speak different languages, either completely different or different because of specialized vocabulary and concerns. Sometimes what others do may not seem "right" and a person might feel that they are doing something she wouldn't do. That is a mismatch of style. If a person goes along with it and sees herself as something other than the identity she has in her other networks, then she can fit in. White calls this a "strategic choice." Stage actors rate high on the self-monitoring scale so it can be learned. Perhaps this accounts for some of the success of Burt's training classes (Steiny and Oinas-Kukkonen 2007), but most importantly it allows for people to be both easily influenced and influential.

Part of the idea of diffusion of innovation is that of "persuasion." Persuasion, like innovation, is something we know about afterwards. If we can tell a story that someone's attitude or behavior changed because of a message from someone else, then we say that person was "persuaded." Clearly, if no change takes place, then no persuasion takes place. There is a long tradition of persuasion going back to the earliest Greeks who had schools where persuasion was taught to people seeking public office or representing others before the polis; those that today we would call politicians and lawyers. A well known summary of various persuasive techniques is *The Rhetorics*, by Aristotle. In *The Rhetorics* Aristotle broke persuasion into several parts. There is a speaker, a listener and an argument, or, in terms now used in marketing "a message." The acceptance of the message rests on three things: 1) the credibility of the speaker, 2) the disposition of the audience, 3) the logic of the argument. The distinction between the role and the individual occupying it is important. The listener will need to interpret any argument that is presented in symbolic form and the interpretation will depend on context. In many cases the message is going to and from roles, not individuals (Steiny Persuasion 2008).

Roles are socially constructed and individuals fill the roles. If we are interested in someone who is "persuasive," or "innovative," or a "leader" or almost any attribute we can assign to that individual, it is important to keep in mind the question "is this a role or an attribute?" This is a difficult question because the separation between roles and attributes is not an easy one to see. Roles are situational and not dispositional, in that they are part of a particular culture at a particular time and they are local to a particular network. Our identity, who we are, is partially given to us by the roles we inhabit.

One of the results of network sociology is the ability to operationalize roles. As was mentioned above, part of the job of a business analyst is to discover the roles in an organization. White laid this out in *Anatomy of Kinship* and *Chains of Opportunity*. White pursued this theme in a number of papers and created the technique of *structural equivalence*.

To compute structurally equivalent sets, the graph is converted to an NxN array with nodes as indices on both dimensions. If there is a link between two nodes, then there is a non-zero value in the corresponding cell, otherwise zero. If two rows in

the array are the same then the nodes are structurally equivalent. This took the folk notion of a “role” and turned it into something that has specific mathematical properties¹

The point here is that from one point of view, there is no contradiction between the idea of “influentials,” “easily influenced,” “high self-monitoring” because we don’t really need to look at the attributes of the individuals we can look at them as becoming these are reasons, but the empirical description of roles is valid. Influence and personality are explanations for what happens, not actions. If we have seen over the years that we tend to tell stories about innovation and leadership of the people in certain roles that we can ascertain by observation, that seems to be what we are after. If we think that when we observe, persuasion, innovation, leadership and so on are roles, not the individuals that inhabit them, the questions about personality and individual intention become meaningless.

Network Awareness in Information Systems

A “relational view” of society, organizations and even individuals provides a valuable alternate perspective to attributional view. It relates to information systems in several different ways. At the lowest level using structural equivalence is a way of identifying roles that does not require ethnographic research or could be used as adjunct to ethnography. An “influential” can be seen as an identifiable role and a network centric view could overcome the question about influence from the role. But so far the relationships have been at an abstract level. Here are some considerations of network awareness at multiple levels of information systems.

Though information systems have done much to improve our lives, they are not without serious problems. This description of identifying roles, task and jobs is a functional explanations of systems.

... a role is then defined by a specified tasks or group of closely interrelated tasks (constituting a job), carried out by people in the development or operation of a system. A person may act in more than one role at a time. (This role concept differs from that commonly used in social psychology where a role is described by the expectations that a person will adapt to in a given position in an organization) (Nygaard 1986, p. 7)

This approach does seem to make process improvements, but it is no secret that an unacceptably large number of IT projects fail. 51% of ERP were considered “unsuccessful” implementations in a Robins-Giona survey in 2001 and comparable surveys show similar failure rates. The number is much higher for CRM systems. It seems that improvement is definitely needed. To the extent we can see the networks and the relations in an organization; we have a new way of measuring and observin. Recall that every node changes when a new link or node is added, where in an attribute or trait based view the others remain the same.

¹ This paper is accepted for publication at Persuasion2008 but the final page numbers are still to be determined.

There are examples of using knowledge of two dimensional networks to solve organizational problem that could be used in information systems. For instance, the story of the strike at the wood processing plant with the three separate groups could apply to information systems planning(Michael 1997). By necessity, observations of work flow and tasks in an organization must be done inductively. The researcher observes a few cases and expands that to a general rule about work flow. Structural equivalence provides a way that roles can be seen and networks, by their very nature, are indicators of flows.

Many network analysis projects have gathered data by surveys and Web based surveys can make analysis easier. However, incomplete network data can be a problem, with apparent structural holes that are actually missing or incomplete data. Traces of IM, cell phone networks and links on social networking sites are valuable new sources of data which reflect the underlying social networks. In principle the data gathering can be increasingly automated and more accurately reflect the underlying networks (Leskovec and Horvitz 2007).

There are views from the micro to the macro about what an information system is. Taking the view that it is software and hardware that aids people in the business of living, network analysis can operate on any of level. So where do social networks fit in? Social networks are representations of interactions between people. Many challenges in organizations have to do with communication. The objects of social networks, persons, groups, communities, roles, brokers and so on are useful ways to think of organizations. What is especially useful is that they can be empirically measured in real time. When organizational changes are made, they can be seen right away. Identifying the key actors in a network could assist in change management. This is being done, and social network analysis is being used in organizations as part of change management, but it could be built in as part of an information system.

At least one company in Silicon Valley is creating generic social networking software that works on cell phones. This software keeps records of the links between people and will use the data to this allows them to have not just a two or three dimensional view of the users, but multi dimensional because the users create networks based on interests, so the networks give some indication of what they mean.

The challenge for information systems might lie in the paradigm of information systems. By necessity a huge amount of the resources for IT has always gone to making management more efficient with management techniques like six-sigma, TQM so on. From a network point of view, this is the step in innovation where the networks become dense for knowledge sharing and task oriented work (Burt 2005). However, the role of leaders is not just administration and information systems but the creation of meaning (Podolny 2005). The systems analyst can create the roles, tasks and flows for the processes but underlying them there is a network of connections that she can't see without tools. It is all well and good to think "they are getting paid, they should do what they are told," but in reality, the system designer cannot know all the contingencies that are faced by people in their day to day work life. The problems they face are often random and occur infrequently to be subject to process. Any organization depends on the problem solving skills of all of its employees to be successful. Network awareness provides another view of the organization; one based on actual connections and not mandated ones.

The tendency in incorporating social networks into information systems is to ask: “how can what we know about social networks be fit into our existing way of doing things?” That brings to mind questions like “how do we find knowledge in our organizations?” This conceives of “knowledge” as a thing that can be looked for and is stored someplace. But that is not a relational view. It is a view that is looking for the attributes of nodes and the network is secondary. Work activity, like economic activity, is embedded in a network of social relations and out of that network emerges “though leaders,” “influentials,” “innovators” and so on, these are not attributes of individuals so no amount of search will find them that way, they are roles in the network and can be discovered as such. We know that different network structures are better for different outcomes. The question becomes: how do we manage it?

It seems that the real answer lies in the distinction I made above about the administrative and the leadership function of management. Until now we have been flying blind, we have had no way of knowing what the networks of human relations in our organizations are like. What is it about these roles, bridges, brokers, thought leaders and others that are part of organizations and helping them function every day? How do the tasks we assign map to the real flow of relations within an organization. Are we, like Dr. Pangloss, looking out and seeing what we want to see, the best of all possible worlds, where happy employees are using our shiny new information systems with glee, when, in fact they are unhappy and not being as productive as they could be? Much research needs to be done, networks provide a new way of looking at persuasion, innovation and leadership, some of the most compelling issues in organizations and information systems.

Contributions

The thesis project resulted in three papers that appeared in peer reviewed journals.

The first paper was a review of White’s book, *Identity and Control*, that appeared in the journal *Social Networks* (Steiny 2007). *Social Networks* has 2006 impact factor of 1.9 and is 6/91 in the Sociology category and 4/52 in the Thomson Scientific Journal Citation Reports. Though the journal is not an information systems journal White’s work is considered difficult to approach and the review provided a foundation for future work incorporating economic sociology into information systems. The author of this thesis is listed as a collaborator on *Identity and Control* (White 2008) and created the index for the book. Though this is not an academic achievement it allowed detailed review of the book and collaboration with the others involved. This helped the author be sure that he was accurately representing the concepts in later work.

The second paper was titled “Networks awareness: social network search, innovation and productivity in organizations” and it appeared in the *International Journal Of Networking and Virtual Organizations* (Steiny and Oinas-Kukkonen 2007). This paper proposed a different way of looking at innovation and productivity in organizations based on a reconceptualization of innovation as partially a product of social networks. This paper introduced the concepts of “network awareness” which, according to theory, can be an important variable for information system success.

The third paper was *Network Awareness, Social Context and Persuasion* and is part of the 2008 Persuasive Technology Conference. This paper brings in White's notion of "roles" and "structural equivalence" to describe context for persuasive messages. It gives further examples of how "network awareness" and the concepts of network sociology can be applied in an information systems setting. It brought in the concept from psychology of "self-monitoring" individuals and showed that they at the same network position as "influentials" and "innovators;" makes the suggestion that network position needed to be considered as an important factor in persuasion, innovation and the diffusion of innovation and showed how the network sociology view might tie together these diverse research threads.

Conclusion and Discussion

The thesis has shown that there is strong indication that a single theoretical approach can explain several seemingly diverse social activities. In economic sociology roles and relations are the empirical facts from which theories are derived. They are not a matter of opinion; two analysts examining the same IM communication networks would get the same results. Of course, the meaning of the results is open to interpretation but many studies have shown that there is strong correlation with the roles we can measure in networks and the roles we perceive from observation. Discovering roles by observation is time consuming, expensive and open to possible subjective bias. Discovering roles using network analysis is mechanical procedure that can be done in real time at a low cost. What is required is a theoretical approach that uses this network information to describe organizations and individuals so that the data have meaning. It is a way to get out of the Panglossian paradigm because it allows us to revisit the roles and relationships longitudinally, it is objective and meaning or values are not part of it. Though for purposes of organizational improvement we will want to give meaning to the roles and relationships we see, we do not start with assumptions that they have functions related to our conception of the purpose of the organization.

The work has uncovered difficulties in building good theory. The most significant one is that little of the research on social networks has been done in the context of information systems. It is not uncommon for information systems research to study attitudes that prevent adoption of technology, but it is uncommon to look at the social networks. All of us are members of different networks and our role in one may supersede our role in another. Empirical study of the importance of the key people in networks, the people who bridge between the worlds in the context of technology adoption needs to be done. The theory holds that the key to adoption of innovation lies not just in what these bridges tell others to do, but because they have a special sensitivity to what others will accept. This points to whole new methods of working with organizations in the adoption of new technology. The theory needs to be strengthened by more empirical work.

References

- Avison, D. and G. Fitzgerald (2003). Information Systems Development. London, McGraw-Hill.
- Azarian, R. (2005). The General Sociology of Harrison C. White: Chaos and Order in Networks. Great Britain, Palgrave MacMillan.
- Baldassarri, D. and P. Bearman (2006). The Dynamics of Polarization.
- Barabási, A.-L. (2002). Linked: The New Science of Networks. Cambridge, MA, Perseus Books Group.
- Berger, P. L. and T. Luckmann (1966). The Social Construction of Reality: A Treatise in the Sociology of Knowledge. New York, Anchor Books
- Burrell, G. and G. Morgon (1979). Sociological Paradigs and Organisational Analysis. London, Heineann.
- Burt, R. S. (1992). Structural Holes: The Social Structure of Competition. Cambridge, MA, Harvard University Press.
- Burt, R. S. (2005). Brokerage and Closure. New York, Oxford University Press.
- Carley, K. M. (2000). "Computational Analysis of Social and Organizational Systems." Organizational Science **34**(2).
- Chase, I. D. (1982). "Dynamics of Hierarchy Formation: The Sequential Development of Dominance Relationships." Behavior **80**: 218-240.
- Chase, I. D. (1985). "The sequential analysis of aggressive acts during hierarchy formation: an application of the 'jigsaw puzzle' approach." Animal Behavior **33**: 86-100.
- Chase, I. D., C. Tovey, et al. (2002). "Individual differences versus social dynamics in the formation of animal dominance hierarchies." Proceedings of the National Academy of Sciences of the United States of America **99**: 5744-5749.
- Cozzens, S. E. (1989). Social Control and Multiple Discovery in Science: the Opiate Receptor Case. Albany, State University of New York Press.
- DeSanctis, G. and M. S. Poole (1994). "Capturing the Complexity in Advanced Technology Use: Adaptive Structuration Theory." Organization Science **5**(2): 121-147.
- Dodds, P. S., R. Muhamad, et al. (2003). "An Experimental Study of Search in Global Networks." Science **301**(5634): 827-829.
- Engelbart, D. C. (1962). Augmenting Human Intellect: A Conceptual Framework - Summary Report AFOSR-3223 under Contract AF 49(638)-1024, SRI Project 3578 for Air Force Office of Scientific Research, Stanford Research Institute, Menlo Park, Ca.
- Fleming, L. (2004). Why the Valley Went First: Agglomeration and Emergence in Regional Inventor Networks. Boston, Harvard.
- Fogg, B. J. (2003). Persuasive Technology. San Francisco, Morgan Kaufmann.
- Freeman, L. C. (2004). The Development of Social Network Analysis, Emperical Press.
- Gould, S. J. and R. C. Lewontin (1979). "The Spandrels of San Marco and the Panglossian Paradigm: A Critique of the Adaptationist Programme." Proceedings of the Royal Society of London. Series B, Biological Sciences **205**(1161): 581-598.
- Granovetter, M. (1990). "The Myth of Social Network Analysis as a Special Method in the Social Sciences." Connections **13**(1-2): 13-16.

- Granovetter, M. (1992). "Economic Institutions as Social Constructions: A Framework for Analysis." Acta Sociologica **35**(1): 3-11.
- Granovetter, M. (2005). "The Impact of Social Structure on Economic Outcomes." Journal of Economic Perspective **19**(1): 33-50.
- Granovetter, M. and R. Swedberg, Eds. (1992). The Sociology of Economic Life. Boulder, Westview Press.
- Granovetter, M. S. (1985). "Economic Action and Social Structure: The Problem of Embeddedness." American Journal of Sociology **91**(3): 481-510.
- Hargadon, A. B. (2003). How breakthroughs happen: the surprising truth about how companies innovate. Boston, Harvard Business School Publishing Company.
- Hargadon, A. B. and Y. Douglas (2001). "When Innovations Meet Institutions: Edison and the Design of the Electric Light." Administrative Science Quarterly **46**: 476-501.
- Iivari, J. and K. Lyytinen (1998). "Research in information systems development in Scandinavia - unity in plurality." Scandinavian Journal of Information Systems **10**(1/2): 135-186.
- Katz, E. and P. F. Lazarsfeld (1955). Personal Influence: the Part Played by People in the Flow of Mass Communication. Glencoe, Ill., Free Press.
- Khurana, R. (2007). From Higher Aims to Hired Hands. Princeton, Princeton University Press.
- Leskovec, J. and E. Horvitz (2007). Planetary-Scale Views on an Instant-Messaging Network. physics.soc-ph. Redmond, WA, Microsoft.
- Lin, Z., X. Zhao, et al. (2006). "Organizational Design and Restructuring in Response to Crises: Lessons from Computational Modeling and Real World Cases." Organizational Science **17**: 598-618.
- Lyytinen, K. and R. A. Hirschheim (1989). Information systems and emancipation: promise or threat? Systems Development for Human Progress. H. K. Klein and K. Kumar. Amsterdam, North-Holland: 115-139.
- Mehra, A., M. Kilduff, et al. (2001). "The Social Networks of High and Low Self-Monitors: Implications for Workplace Performance." Administrative Science Quarterly **46**(1): 121-146.
- Michael, J. H. (1997). "Labor dispute reconciliation in a forest products manufacturing facility." Forest Products Journal **47**: 41-45.
- Mizruchi, M. S. and B. B. Potts (1998). "Centrality and power revisited: actor success in group decision making." Social Networks **20**(4): 353-387.
- Mizruchi, M. S. and L. B. Stearns (2001). "Getting Deals Done: The Use of Social Networks in Bank Decision Making." American Sociological Review **66**(5): 647-672.
- Monge, P. R. and N. S. Contractor (2003). Theories of Communications Networks. New York, Oxford University Press.
- Mullins, N. C. (1973). Theories and theory groups in contemporary American Sociology. New York, Harper & Row.
- Newman, M. E. J., D. J. Watts, et al. (2002). "Random Graph Models of Social Networks." PNAS **99**(suppl. 1): 2566-2572.
- Nygaard, K. (1986). Program Development as a Social Activity. Information Processing. H. J. Kugler. North Holland, Elsevier Science Publications. **86**: 189-198.
- Oinas-Kukkonen, H. and M. Harjuma (2008). Towards a Deeper Understanding of Persuasion in Software and Information Systems. The First International Conference on Advances in Human-Computer Interaction, Sante Luce, Martinique.
- Podolny, J. M. (2005). Revising The Meaning of Leadership. Amsterdam, Elsevier.

- Poole, M. S. and R. D. McPhee (1983). A structural theory of organizational climate. Communications and Organizations: An Interpretive Approach. L. Putnam and M. Pacanowsky. Beverly Hills, CA, Sage: 195-219.
- Romo, F. P., and Schwartz, Michael (1995). "The structural embeddedness of business decisions: the migration of manufacturing plants in new york city, 1960 to 1985 " American Sociological Review **60**: 874-907.
- Saxenian, A. (1996). Regional Advantage. Boston, Harvard University Press.
- Schwartz, M. and H. C. White. (1966). "Harvard Department of Social Relations." from <http://isnae.org/Resources/DepartmentOfSocialRelations/>.
- Steiny, D. (2007). "H. White, Identity and Control (2nd ed.), Cambridge University Press, Cambridge (2008)." Social Networks **29**(4): 609-616.
- Steiny, D. and H. Oinas-Kukkonen (2007). "Networks awareness: social network search, innovation and productivity in organisations." International Journal of Networking and Virtual Organisations **4**(4): 413-430.
- Suzuki, L. and J. Aronson (2005). "The Cultural Malleability of Intelligence and Its Impact On the Racial?Ethnic Hierarchy." Psychology, Public Policy and Law **11**(2): 320-327.
- Swedberg, R. (1997). "New Economic Sociology: What Has Been Accomplished, What Lies Ahead." Acta Sociologica **40**: 161-182.
- Tilly, C. (2005). Boundaries, Identities and Social Ties. Boulder, CO, Paradigm Publishers.
- Times, L. (2007). The elementary DNA of Dr Watson. The London Times. London, London Times.
- Valente, T. W. (2006). Bridges and Potential Bridges: Changing Links to Find Critical Paths and Nodes in a Network.
- Valente, T. W. and P. Pumpuang (2007). "Identifying Opinion Leaders to Promote Behavior Change." Health Educ Behav **34**(6): 881-896.
- Watts, D. J. (2004). Six Degrees of Separation: The Science of a Connected Age. New York, W.W. Norton and Company.
- Watts, D. J. and P. S. Dodds (2007). "Influentials, Networks, and Public Opinion Formation." Journal of Consumer Research, Inc.
- Wellman, B. (1988). Structural analysis: from method and metaphor to theory and substance. Social Structures: A Network Approach. B. Wellman and S. D. Berkowitz. Cambridge, Cambridge University Press.
- White, H. C. (1981). "Where Do Markets Come From?" The American Journal of Sociology **87**(3): 517-547.
- White, H. C. (1992). Identity and Control: A structural theory of action. Princeton, New Jersey, Princeton University Press.
- White, H. C. (2008). Identity and Control: How social formations emerge. Princeton, New Jersey, Princeton University Press.