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Role of Ties in Knowledge Networks

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IDT 895: Knowledge Management

June 29, 2008

Abstract

This paper surveys sociology literature to consider prior theory and research on social networks with the goal of assessing how knowledge-based networks function. Findings from network analysis, including theory and research surrounding Granovetter's network ties theory, provide insight into how networks are structured and the implications for innovation, diffusion, economic outcomes, and collective action. Network analysis theory and research provides support for knowledge-based networks as conduits for innovation and knowledge sharing. Knowledge management practices should focus on the development of weak tie bridges across organizational units and promote interdependence among strong tie network units.

The Role of Ties in Knowledge Networks

The increasing attention placed on knowledge management practices is producing a like interest in social network analysis (Allen, James, & Gamlen, 2007). Networks are heralded as conduits for knowledge sharing and innovation (Davenport & Prusak, 2000). The 2004 publication *Innovation in the knowledge economy: implications for education and learning* from the Organisation for Economic Co-operation and Development (OECD) highlights the possibilities for innovation that are created when unrestricted access and a free flow of information exists within knowledge-based networks. The overriding premise is that through open access to people, technologies, and information, new and exciting avenues for knowledge generation, innovation, and sharing are possible.

While the focus is often on the power of computer-mediated communication tools to support and foster globally connected networks, are the tools the key to innovation facilitation or is it the network structures that are important? What is known about the social construction of these networks? What can be learned about the networks from past theory and research? This paper surveys sociology literature to assess prior theory and research on social networks with the goal of assessing how knowledge networks function.

Social Network Research

Notable Researchers

The bulk of modern social network analysis theory and research has been produced since the late 1960s and early 1970s (Burt, 1992). Notable current network analysis researchers over this time include Ron Breiger, Ronald Burt, Mark Granovetter, David Knoke, Peter Marsden, Barry Wellman, and Harrison White (Emirbayer & Goodwin, 1994). Table 1 highlights where

these researchers completed their doctoral programs and their current positions. As noted, most graduated in the late 1960s to mid 1970s and many were contemporaries at Harvard University.

As a measure of each researcher's publication history, the number of papers and citations linked within the Thomas Scientific ISI Web of Science database as of June 22, 2008 are also listed in Table 1. All have published extensively in the area of social network analysis. While Granovetter has one of the lowest publication rates of his contemporaries, his works have received double the citations as the next highest researcher.

Table 1. Notable network analysis researchers and their academic and publication histories.

Author	Publications	Times Cited
Breiger, RL Ph.D., Harvard University (1975) University of Arizona, Professor of Sociology	21	975
Burt, RS Ph.D., University of Chicago (1977) The University of Chicago, Professor of Sociology	70	2,852
Granovetter, M (and MS) Ph.D., Harvard University (1970) Stanford University, Professor of Sociology	28	5,723
Knoke, D Ph.D., University of Michigan (1972) University of Minnesota, Professor of Sociology	110	1,182
Marsden, PV Ph.D., University of Chicago (1973) Harvard University, Professor of Sociology	81	1,695
Wellman, B Ph.D., Harvard University (1969) University of Toronto, Professor of Sociology	100	1,690
White, H (and HC) Ph.D., Massachusetts Institute of Technology Ph.D. Princeton University (1955) Columbia University, Professor of Sociology	120	1,526

Notable Research

Following an extensive review of network research literature, Hoang and Antoncic (2003) found three primary threads of research, including: 1) the content of the network relationships, 2) the governance of the network relationships, and 3) network structure, including patterns of relationships from direct and indirect ties within the network. The area that has

attracted the most social network research attention is based on the theories of network tie strength (Marsden & Campbell, 1994). Within a recent literature review on network analysis, Jack (2005) notes that most network studies use and apply Granovetter's network tie hypothesis.

Network Ties

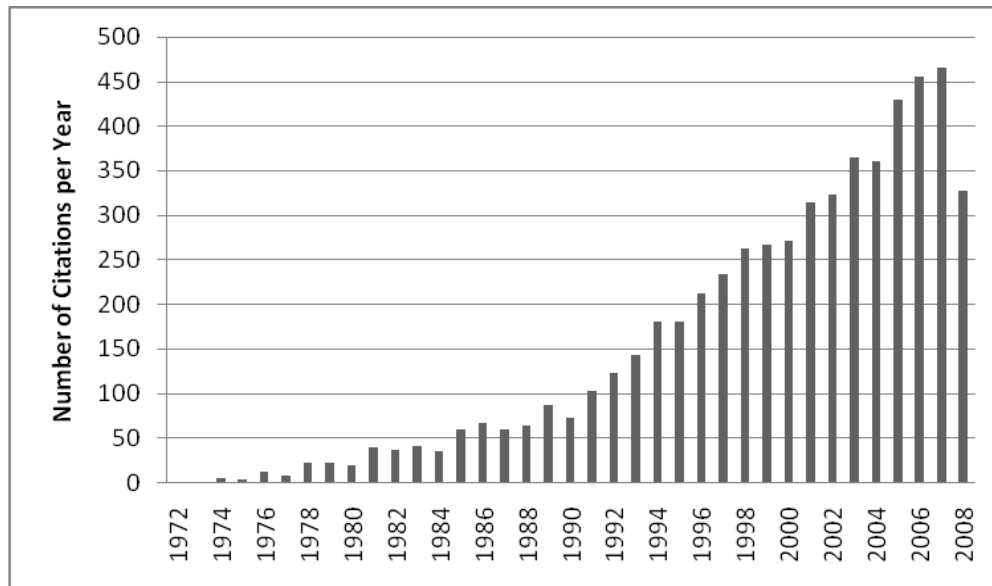
Granovetter began studying network ties in his doctoral research at Harvard University (Burt, 1992). He outlined his theory on network ties in his first journal publication in 1973 entitled "The Strength of Weak Ties" published in *The American Journal of Sociology*.

Granovetter (1973) suggests social networks analysis as a way to bridge micro and macro levels of sociological theory. He argued that while both micro issues relating to small groups and macro issues, such as diffusion, social cohesion, social mobility, and community organization, were being heavily researched, there was a lack of focus on their interaction. Therefore, Granovetter focused his attention on the strength of interpersonal ties and the resulting impact on macro level issues.

Increasing Interest in Network Tie Theory

While Granovetter (1983) revisited and expanded his theory on network ties, the interest in his original work has steadily increased. Based on the noted citation information from the Thomson Science ISI Web of Science database, Figure 1 highlights the sharp and continuous increase in the numbers of papers citing Granovetter's 28 publications listed in the database, including over 300 citations already in the first six months of 2008. Notably, over 40% of Granovetter's total citations are to his original 1973 publication.

Figure 1. Citations of Granovetter's Publications, as of June 2008.



Strength and Structure of Network Ties

Strength of network ties. Granovetter (1973, p. 1361) defined the strength of a tie as a “combination of the amount of time, the emotional intensity, the intimacy (mutual confiding), and the reciprocal services which characterize a tie.” As such, a tie can be considered strong, weak, or absent. Given the amount of time needed to form a strong tie, Granovetter suggested that the stronger the tie between individuals, the greater the overlap in their friendships.

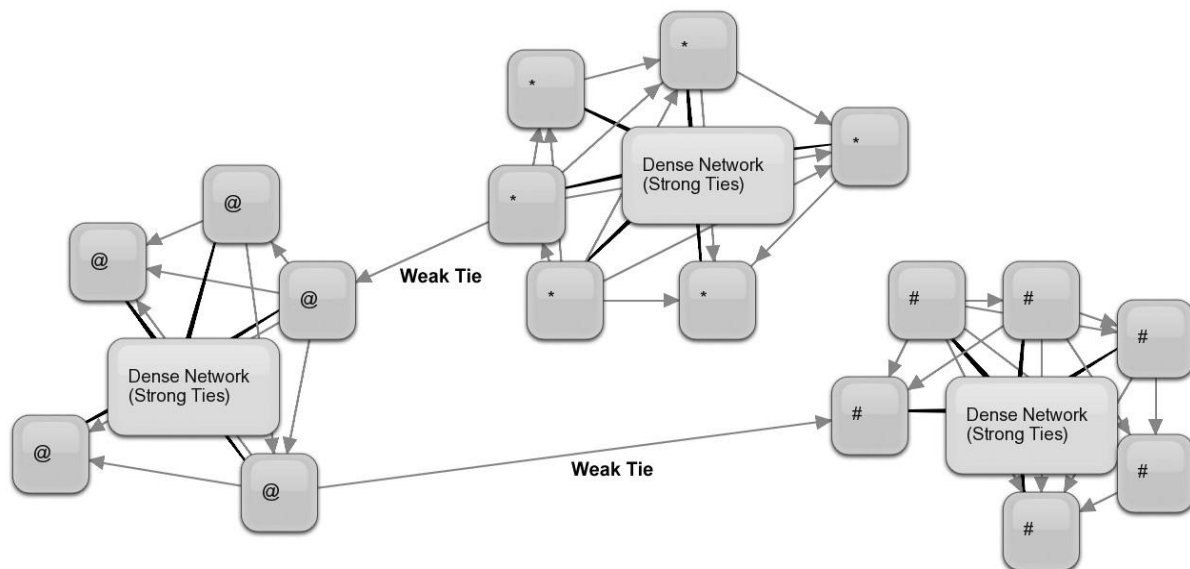
Density of network. Linked to this overlap in friendships, *density* refers to the proportion of possible connections among individuals (or nodes) and is measured by the extent to which individual's contacts are interconnected (Hoang & Antoncic, 2003). Therefore, denser networks have more unique paths between any two given nodes. Research suggests that due to cognitive and emotional limits on the number of social ties a person can have, larger groups will have lower density than small groups (Granovetter, 2005).

Holes in network. Burt (1992) expanded upon Granovetter's network model by focusing on the importance of network holes which exist in the absence of network ties. While

Granovetter's original hypothesis focuses on the significance of all bridges being weak ties, Burt's emphasis is on the network holes which are bridged. Burt argues that people with ties into multiple networks have a strategic advantage and can exploit *structural holes* in the network. Therefore, the individual in the bridging position holds power and influence over those unconnected to the broader network (Hoang & Antoncic, 2003).

From these descriptions of network structure is the conception of networks comprised of clusters of strong tie relationships bridged by weak tie acquaintances, as illustrated in Figure 2. By making a case that all bridges are weak ties, Granovetter (1973) laid the groundwork for theory and research on social structure beyond the primary group and on relationships between groups.

Figure 2. Strong and Weak Interpersonal Ties.



Implications of Network Ties

As noted, Granovetter's theories and research and the numerous studies that followed have assessed the implication of strong and weak tie relationships within a network. Based on theory and research findings, the following highlights the implications of strong and weak

network ties on diffusion, innovation, bridging value, economic outcomes, norms, and collective action.

Diffusion and message transmission. Given Granovetter's assumption that all bridges are weak ties, there are important implications regarding diffusion and new message transmission. Granovetter (1973) suggests that while hundreds of diffusion studies had been carried out by Rogers and others, the importance of weak ties in diffusion had not been considered in prior research. Granovetter argues that new information spreads among separate clusters of people through the weak ties. Implicit in this argument is that those individuals and clusters of individuals with few weak ties will not benefit from new messages from other social clusters and diffusion will be hampered. Unfortunately, research also suggests that while weak ties may facilitate the transmission of new information, the transmissions through indirect ties often become distorted and the messages are prone to misunderstanding (Hansen, 2002).

Innovation. Innovation often requires the creation of new relationships and connections to novel resources, knowledge, and information. Burt (1992) suggests that given the overlap of common relationships in dense networks of strong ties, it takes weak ties with acquaintances in different social clusters to receive and share novel information. Therefore, weak tie acquaintances who move in different social networks become a bridge to people and information in other networks (Granovetter, 2005). However, as discussed below, the structural holes over which these weak ties bridge create problems when it comes time for collective action and sustained collaboration given the different interests of the weakly connected parties and the dispersed nature of the connection (Obstfeld, 2005).

Bridging value. Related to the ideas already discussed, Granovetter (1973) argues that acquaintances with weak ties are able to facilitate connections to other social networks and, in

turn, offer increased mobility through new connections to other social clusters. Research has offered only partial confirmation of this. Findings suggest that those in lower socioeconomic groups tend to connect primarily to friends or relatives and do not experience the same mobility benefits as those in higher socioeconomic groups (Granovetter, 1983). These findings led Granovetter (1983) to refine his original theory to suggest that while all weak ties are bridges, the *value* of each bridge is not equivalent.

Economic outcomes. Granovetter (1985) ties his network analysis theory and research to the role social structure plays within economics in a paper entitled “Economic Action and Social Structure: The problem of embeddedness” published in *The American Journal of Sociology*. This work has been cited over 2,500 times making it one of the most cited publications in sociology (Fligstein & Dauter, 2007). Beyond the role of networks in personal interactions, Granovetter argues that social network relationships play a key role in economic action and outcomes. According to Uzzi (1997, p. 35), Granovetter’s argument of the embeddedness of social structures in economics “emerged as a potential theory for joining economic and sociological approaches to organizational theory.”

Network norms. Network density plays a role in establishing norms within the network. Research suggests that in dense networks of strong ties, the high proportion of connections among individuals makes it more likely that norms will form within the network (Granovetter, 2005). However, given the relatively lower density of large groups, larger groups tend to have less ability to set and enforce norms.

Collective action. Network ties and density also have also been shown in network research to play a role in establishing collective action within the network. As a follow up to earlier research by Granovetter, Macy (1991) assessed the propensity of an individual within a

network to work with the group. Contrary to other theories which would suggest individuals participate based on perceptions of individual gain, Macy's findings suggest that when a person's participation depends upon the participation of another within the network, the interdependence facilitates what is termed a *coordination of contributions*. This notion of what propels network collective action is very similar to the idea of *general reciprocity obligations* in which an assumed condition of membership to a network is participation (OECD, 2004). In other words, when the cost of member to a network is participation, the assumed reciprocal obligations fuel collective action and discourage lurkers within the network.

Critique of Granovetter's Network Theories

In 1974, Granovetter published a reply to a critique of his early network theories from Herbert Gans within an article in *The American Journal of Sociology*. In the 1960s and 1970s when the first publications of network theory were making their way into sociology journals, the relevance of social networks was contested. The debate between Granovetter and Gans in the 1974 article is not about the *existence* of networks, but rather the *importance* placed on them. In his reply to Gans' original critique, Granovetter stresses the need to study network structures and characteristics as important variables affecting macro social issues. However, Gans (p. 529) argues in his subsequent response within the article that Granovetter overemphasizes the "explanatory power of network factors."

Similarly, in a comprehensive review of network analysis, Emirbayer and Goodwin (1994, p. 1412) note that "network analysis has yet to be subjected to a theoretically informed assessment and critique ... or systematic inquiry in its underlying strengths and weakness." In concluding their review, they suggest that while network analysis has an intriguing theoretical

foundation that helps to *describe* patterns of relationships, it is not sufficiently developed to assess the relationships themselves.

Further, while there is now widespread agreement that social influences affect economic performance (Jack, 2005), it is important to note the context within which Granovetter's theories were initially conceived and received. Granovetter's theories of network ties and social embeddedness are viewed as central to the *New Economic Sociology* movement which focused on the social context of economic acts and was critical of mainstream economics' disregard for the effect of social influences on economic actions (Velthuis, 1999). However, while his theories of social embeddedness have now been integrated into mainstream economic and sociology debate, they have been challenged for their "theoretical indefiniteness" and inability to "explain some forms of economic action better than do pure economic accounts" (Uzzi, 1997, p. 35).

Areas for Future Research

Given the reach of Granovetter's work across both sociology and economics, countless areas of future research are suggested within prior evaluations of Granovetter's network theory. Yet, one of the most fundamental questions regarding network ties appears to remain unanswered. Granovetter (1983) suggests that while weak ties act as bridges, not all weak ties provide the same bridging effects. Therefore, he called for an investigation of the origin and development of weak ties to compare the characteristics of those weak ties which act as successful bridges between clusters of relationships and those that do not. Based on a review of literature, it appears this remains an area for further investigation.

In addition, there are calls for research to further evaluate how network content, governance, and structure emerge and develop across network tie relationships over time (Hoang & Antoncic, 2003; Jack, 2005). Tied to this is an evaluation of the *interplay* between dense

networks of strong ties and weak ties. Obstfeld (2005) suggests that while strong ties in dense networks have been shown to inhibit innovation, they have also been shown to effectively support collective action making interactions between dense networks and weak ties ripe for further study.

Conclusions

Network analysis theory and research provides guidance for those who see knowledge-based networks as conduits for innovation and knowledge sharing. Findings surrounding Granovetter's social network tie theories provide insight into how networks are structured and, in turn, the implications for innovation, diffusion, economic outcomes, and collective actions. Each of these areas is vital to effective knowledge management practices.

The assumption in network analysis that networks consist of clusters of individuals with strong ties linked together by weak tie associations provides a framework to establish knowledge-based network practices. As suggested by research, the key to innovation is fostering and utilizing weak tie connections. From a knowledge management perspective, this suggests the importance of developing inter-unit bridges. Organizations that span structural holes in their networks of clustered autonomous units will have a strategic advantage over those who do not.

However, research also suggests that densely clustered strong tie relationships are crucial to collective action. While weak tie relationships help to usher in new ideas, people, and resources, it takes coordination of contributions for successful collective action. From a knowledge management perspective, this suggests nurturing avenues for collective participation. As research indicates, if one person's participation depends upon the participation of another in the network, the interdependence fuels reciprocal obligations which in turn foster continued collective action. Interdependence becomes the motivator to participate. For example, Sharon

will be motivated to participate if she thinks, “If I do not agree to help Bob, he will not have time to contribute to Steve’s project which I need to have in order to finish my project.”

Therefore, knowledge management practices must focus on the development of weak tie bridges to new people, information, and tools. However, these practices must go beyond simply providing general access or making casual introductions. As noted above, the value of weak tie bridges are not equivalent. Therefore, emphasis should be placed on connections which hold the most value. Further, knowledge management practices must also promote interdependence among network members. By doing so, strong and cohesive networks will benefit from flows of fresh information, expertise, and resources and will be equipped to collectively undertake new opportunities as they are presented.

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