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A Note on Social Networks and Network Structure

People intuitively know that networks matter—that where someone is located in the social space and who that individual is connected to can affect that person's power and influence and even his or her career trajectory. Research conducted during the past 30 years has provided a lot of empirical support as well as specificity to this intuition. This note briefly reviews some of the major findings and ideas from the social networks literature and provides resources for further reading and study (in the footnotes) for those who want to pursue this topic further.

The Strength of Weak Ties

Tie strength is an important dimension of social relations. Tie strength can be assessed by whether or not the tie is reciprocated (reciprocated ties—relationships that are mentioned by both parties—are likely to be stronger), the frequency of the interactions that occur between people, and the degree of trust and interpersonal intimacy in the relationship. Although close interpersonal relationships are obviously valuable for social support, the literature suggests that having lots of relatively weak ties may be actually more beneficial for a number of outcomes including career progression and innovation.

1n 1974, Mark Granovetter[1] wrote *Getting a Job*, an empirical study of how people actually found jobs. Not surprisingly, one of the findings was that the survey respondents were more likely to find higher level managerial jobs through personal contacts as compared to more formal mechanisms such as advertisements or filling out an application. The job finding process differed by job type, with the managerial jobs as contrasted with either technical or lower level jobs being more likely to be found through personal contacts. But what was surprising was that the social relationships most useful for finding a job were *weaker*, in that they were more likely to be casual acquaintances rather than close friends or family members. The idea that weak ties might be more useful for career processes makes sense when one considers that strong ties, people close to you, are also likely to be close to each other and to other people you already

[1] Granovetter is a professor in the Stanford Sociology Department and teaches courses in economic sociology. See, Mark Granovetter, *Getting a Job: A Study of Contacts and Careers*, Boston: Harvard University Press, 1974; Mark Granovetter, "The Strength of Weak Ties," *American Journal of Sociology, 78* (1973), 1360-1380.

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know, whereas more casual acquaintances are less likely to know the same people and travel in the same social circles as you or each other. Therefore, it is likely that you will uncover less redundant information through weak ties than you will through those people you are more strongly connected to through, for instance, either kinship or close friendship relations.

The idea that weak ties are useful for finding a job logically requires not just that you are able to access more diverse information, but it also implies that people to whom you are weakly tied, with whom you share relatively few connections or experiences, are nevertheless going to be willing to help you, at least to some extent, in the job search process. Therefore, the idea that weak ties are helpful is also based on the social psychological finding that people are more likely to help someone with whom they share something in common—*but that what they need to share to build a shared social identity that can be used to access assistance can be relatively trivial and even random*. So, for instance, experiments have found that people are more likely to provide help to others if they believe they have the same birthday (which is a completely random and non-informative similarity), the same initials, the same first name, and so forth. Thus, the very fact that people know one another and have shared almost any common experience can be sufficient to elicit at least some level of help and information.

The weak ties argument coupled with the fact that one needs to share relatively little with others to elicit compliance suggests that an optimal networking strategy is to know a lot of different people who travel in different social circles, have different organizational affiliations, are geographically dispersed, and so forth, but not necessarily to know them very well or to develop very close or strong ties with them (e.g., Keith Ferrazzi's strategy).[2] However, as one might suspect, although weak ties are great for accessing information efficiently, such ties are not necessarily so perfect if one needs substantial help from someone to whom you are only weakly tied.

In 1999, Morten Hansen[3] wrote a very influential paper on the search-transfer paradox. Hansen studied the transfer of information relevant to product design and development in a large, global high technology company. In high technology development, it is often the case that ideas, techniques, even pieces of software code or hardware, can be used in multiple products—*if* people know about these technologies (the search problem) and *if* they can access this knowledge and technology (the transfer issue). Hansen gathered detailed information on the network structure of people working in different product teams and also a lot of information on how well the product development efforts did (measured mostly by time to completion) as well as the actual transfer of ideas and technologies across the teams working in this large, geographically dispersed organization. Hansen found that a network structure rich in weak ties was efficient for *uncovering* technologies that could help in the product development effort. As long as such technologies were reasonably codified and explicit (e.g., a circuit diagram, software code that was documented and written down), groups whose members had networks rich in weak ties outperformed others. But, if the technology that needed to be transferred was tacit, in that it was

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[2] Victoria Chang and Jeffrey Pfeffer, "Keith Ferrazzi," Stanford, CA: Graduate School of Business Case #OB-44, October, 2003.

[3] Morten Hansen received his Ph.D. at Stanford and then taught at Harvard Business School. He is currently a faculty member at INSEAD. See Morten Hansen, "The Search-Transfer Problem: The Role of Weak Ties in Sharing Knowledge Across Organizational Subunits," *Administrative Science Quarterly, 44* (1999), 82-111.

uncodified and the only way the technology could be accessed was by the investment of time on the part of someone from another group to help in this transfer, then strong ties were better as the stronger social relationships were more likely to generate the investment of effort required to successfully transfer tacit knowledge.

So, there is a trade-off: weak ties permit the accessing of lots of diverse information but strong ties are likely to produce more substantial assistance, and are therefore more useful when more investment on the part of interaction partners is required for task accomplishment.

Network Structure: Bridging Structural Holes

Another dimension of networks besides tie strength is connectedness. One dimension of connectedness is centrality. People often want to be central—meaning that many people are tied to them and they sit at the hub of the communication structure. And centrality is related to power, in that in a communication network in which people are otherwise equal, it is the case that the most central individual can exercise more control over the information sharing and decision making process because of his or her structural position. However, it turns out that what matters for understanding how networks affect salary and position attainment is not just your own network centrality but also the relationships and network connections among those to whom you are tied.

In many instances, because of the tendency of people to associate with others who are similar to themselves in terms of attitudes, demographic characteristics such as gender, race, and age, and geographical location (all of which are sometimes referred to as the tendency toward homophily), groups or organizations that might profitably gain from interacting with others don't do so, or don't do so easily or as often as they might. This creates an opportunity for profiting by building "brokerage" relations—or, to the use the terminology of Ron Burt, by bridging the structural holes that exist between non-interacting groups.[4] The fundamental idea is deceptively simple: by connecting groups that are tightly interlinked *within* the group but are socially isolated from each other, the individual doing the connecting can profit.

We see this effect every day in a variety of businesses and professions. Consider, for instance, the venture capital industry. Venture capital firms connect people who are building new enterprises to sources of funding. The entrepreneurial team is typically tightly connected with each other—they interact frequently and may have previous social and professional ties. Their frequent interaction is moreover a natural consequence of being highly focused on achieving some particular technology and business objective. Meanwhile, potential investors such as pension funds, endowments, or family offices are also typically linked—they attend similar professional meetings, may have held positions with other firms in the money management

[4] Ron Burt is a professor at the business school at the University of Chicago. I highly recommend accessing his personal website if you are interested in networks and network analysis, as he makes available both a questionnaire for gathering information about your network and a computer program for analyzing these (or any other) network data. One link to his materials is: http://www.chicagogsb.edu/fac/ronald.burt. For a discussion of structural holes and the opportunities bridging them present, including relevant evidence, see Ronald S. Burt, *Structural Holes: The Social Structure of Competition*, Cambridge, MA: Harvard University Press, 1992; and Ronald S. Burt, *Brokerage and Closure: An Introduction to Social Capital*, Oxford: Oxford University Press, 2005.

industry, and may have worked together at the same previous employers. But the two groups are not well linked to each other, sharing in many instances neither geographical proximity, professional associations, nor educational background. Therefore, it is difficult for the money managers to both find and then evaluate potential entrepreneurial new ventures, and it may be difficult for the entrepreneurs to find sources of funding. Hence, the venture capital industry operates to link investors with investment opportunities, and can earn handsome returns by doing so. Similar processes operate within companies. People who can bridge the various departments or units necessary to bring a new product or service to market, such as engineering, marketing, and sales, are in a position to a) get things done and thereby build a career-enhancing reputation, b) see opportunities that others without their range of contacts and hence information can miss, and c) profit from making these connections. Indeed the very word, *entrepreneur*, has as one of its root meanings the idea of "standing between."

The empirical evidence suggests that bridging structural holes is profitable. Burt's (and others') research finds that social capital, measured essentially as how many structural holes one bridges, is positively related to career success (as measured by promotions and the attainment of higher levels in the organizational hierarchy) and salary. Additionally, Burt has reported that holding a favorable network position—being in a brokerage role—not only provides a direct effect on promotion and salary (for instance, in an investment banking firm) but also increases the individual's returns to human capital such as education and experience. Social capital and human capital are, therefore, both important, and social capital can increase returns to an individual's human capital by providing the "social leverage" for employing skills and knowledge.

It is not only individuals who benefit through brokerage activities. Burt has found that companies with more people who bridge structural holes are able to implement new ideas and new technologies more readily and also are more innovative. In fact, as Andy Hargadon[5] has shown, successful product innovation is much less a result of individual genius but is instead a consequence of the ability to be a technology broker—to combine pieces of technology and ideas from disparate industries and products in new combinations. Technology brokering is one acknowledged source of the success of IDEO—the oft-recognized leader in the product and experience design consulting space.

One other finding by Burt is relevant as we think about networks and our positions in them. One might conjecture that being connected to someone else who filled various structural holes might be almost as beneficial as doing the connecting oneself, or that, in other words, we can profit from the ties of others to whom we are tied. However, in a set of empirical studies, Burt found that this was *not* true. The benefits of network position decline quite steeply as one is farther from the brokerage role, and even one step of removal (being tied to someone who is filling a large number of structural holes) decreases the degree of benefit almost completely. The lesson

[5] Hargadon received his Ph.D. from the Management Science and Engineering department at Stanford (my colleague and co-author, Bob Sutton was his thesis advisor) and now teaches at U.C.-Davis. He and Bob have intensively studied the award-winning product development firm IDEO as well as technology brokerage and innovation more generally. For those interested in learning about technology brokerage and innovation, see Andrew Hargadon, *How Breakthroughs Happen: The Surprising Truth About How Companies Innovate*, Boston: Harvard Business School Press, 2003.

here is that you have to do the network "work" yourself if you want to achieve the advantages of bridging structural holes.

Network Structure: Connectedness and Cohesion

Transactions require more than people being connected to each other. Transactions invariably depend on trust. No one is going to have the time or interest in personally verifying every detail and piece of information. To return to the venture capital (or for that matter, the internal venturing) example above, entrepreneurs are going to rely on the VC's when they assure them of their ability to deliver funding and investors are going to rely on the VC's due diligence and not replicate the process of examining the team and its technology first-hand. Inside companies, engineers will rely on the broker who provides information from marketing about market needs and marketers will rely on estimates concerning product costs and launch times without checking on every piece of data. But as anyone who even casually reads the business press well understands, trust can—and is—violated. Uncovering instances of bad behavior and sanctioning same is made much easier to the extent that networks are cohesive—that is, there are more connections and fewer "holes." The wholesale diamond market in New York is one example of how a densely connected network uncovers and sanctions bad behavior to such an extent that the need for written contracts is virtually obviated.

Thus, there is an apparent paradox. You are not only more likely to trust someone to whom you are personally more strongly tied, you are also more likely to trust and rely on the word of someone who is more tightly connected into your network, because you know that the greater the number and intensity of ties, the more certain and punishing will be sanctions for breaches of trust. As Granovetter has written, "My mortification at cheating a friend of long standing may be substantial even when undiscovered. It may increase when the friend becomes aware of it. But it may become even more unbearable when our mutual friends uncover the deceit and tell one another." Conformity to social norms, to take one example, is much higher in a group of friends or co-workers than in a group of strangers. And uncovering malfeasance is much more likely with the redundant information that flows through a more tightly and richly connected social network.

But as Burt points out in his 2005 book, *Brokerage and Closure*, the paradox is more apparent than real, because the optimal network structures within as contrasted with connecting groups can, and do, differ. His data show that group performance is highest when there is network closure *within* groups—ensuring trust and the rapid diffusion of accurate information about individual reputations—and brokerage *beyond* or between groups, ensuring the transfer of relevant information and coordination among different entities. This idea is reminiscent of the debate about the advantages of strong culture organizations. The argument is sometimes made that although strong culture organizations are effective for mobilizing action and ensuring coordination within a social unit, there must be some disadvantage in terms of organizational learning and adaptation to changing circumstances in the companies' environment. But this is not the case. It is possible for a group to be internally cohesive—richly and densely interconnected inside—and still be linked to numerous external organizations and groups and, in fact, brokering relationships among them.

Structural Equivalence and Competition

Network ideas have also been used to understand who is and is not a competitor and the distribution of profits across the economy or any other set of interacting parties. Consider the case of competition first. Who is a competitor? A network analysis answer would be: entities that occupy structurally equivalent positions. Structural equivalence simply means that network structures are more similar, in that social actors are connected to the same, or the same types, of others in a similar fashion. Presumably firms in the same industry making similar products have similar patterns of relations with suppliers of materials and services and with distributors and purchasers of their products. Their networks of relationships would be structurally equivalent. Network theorists argue that using network similarity to define who is a competitor provides not only a more precise way of ascertaining competition but also a better way of understanding its dynamics and consequences. As Burt noted, "competition is a matter of relations, not player attributes."[6]

For instance, one argument is that structural equivalence is actually more useful than models of social contagion for explaining the diffusion of innovations. Competition often breeds imitation because copying what a competitor is doing and benefiting from doing so reduces the uncertainty of adopting a particular strategy or technology. Therefore, the diffusion of new technologies or ideas spreads across structurally equivalent, but not necessarily *connected*, social units. Ron Burt[7] reanalyzed data from one of the original classic diffusion studies, the examination of the spread of the antibiotic, tetracycline.[8] The typical diffusion framework is epidemiological in its theoretical premise: new products, or ideas, or treatments, diffuse through direct social contact. But Burt found that physicians in structurally equivalent positions were more likely to imitate others who had adopted the new drug, and that there was little evidence that diffusion actually followed contact networks. Rather, doctors copied the behaviors of others in structurally similar positions—possibly as a competitive response or because they believed that those in similar network positions provided reliable guides to how they themselves should behave.

The Network Foundation of Constraint and Autonomy and the Relationship to Profit

Network ideas can also help predict the profitability of various industries (and do so more effectively than considering the effect of industrial concentration) and, for that matter, the "profit" (or social returns) earned by people in different positions.

The intuition proceeds as follows. Profits follow power—more powerful industries, more powerful companies, more powerful individuals—are able to extract more economic surplus for themselves. But power is the obverse of dependence—to the extent that a social actor is dependent, it has less power. Dependence is a function of two things: the extent to which a social actor needs something from another, and the inability to obtain that needed resource or behavior from alternative sources. This can be defined in network terms as autonomy or its opposite, constraint. Burt found that measures of network constraint, derived from input-output

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[6] Burt, *Structural Holes*, p. 3.

[7] See Ronald S. Burt, "Social Contagion and Innovation: Cohesion Versus Structural Equivalence," *American Journal of Sociology, 92* (1987), 1287-1335.

[8] J. S. Coleman, E. Katz, and H. Menzel, *Medical Innovation*, New York: Bobbs-Merrill, 1966.

tables showing exchange relations among sectors of the U.S. economy, can in the first instance predict industry-level profitability.[9] Because organizations that are constrained want to manage those constraining relationships, there is also data suggesting that patterns of mergers, joint ventures, and board of director interlocks follow patterns of network constraint.[10]

One Other Trade-Off: Building and Maintaining Social Relationships versus Substantive Task Performance

Bridging structural holes and developing relations, even relatively casual ones, with lots of disparate people obviously takes time. One of the common reactions to cases on people such as Keith Ferrazzi or venture capitalist Heidi Roizen, both of whom have lots of contacts and connections, is that they aren't doing real work. Holding aside for the moment the fact that brokering connections among people or organizations who can be helpful to each other is an important and socially useful task in and of itself, the comment does speak to an important issue: time is not infinite in supply and time spent in network building or brokerage activities is time that can not be spent doing other things.

Research by Morten Hansen and his colleagues on 67 new product development teams found that the "value" of networks of different types depended on the nature of the product development effort.[11] Using a distinction common in the organizations literature and associated with the work of James March, the study distinguished between product development efforts that entailed "exploration"—essentially doing things that are quite new (at least for the organization doing them)—and those that involved "exploitation"—leveraging already acquired existing skills and competencies. While teams engaged in exploration-type product development efforts benefited (in terms of time to completion) from having many non-redundant social ties, teams exploiting existing technological knowledge actually took longer to complete their projects with this type of network structure. That's because external ties take time to maintain and, moreover, require reciprocal help, but in the case of product development efforts that essentially leveraged existing knowledge, such ties were not needed for the task but nonetheless costly to maintain.

The conclusion of the limited research that has been conducted on the issue of doing "network" versus "other" work suggests a few things. First, some balance between building networks and social ties and engaging in other forms of work is desirable. Second, other things being equal, just as there are advantages to being efficient in getting one's work done, there are also undoubtedly advantages in being an "efficient" networker. There is evidence, for instance from the follow-up of what happens to people who take courses or classes with Ron Burt, that network skills, like other skills, can be learned and improved. There are obviously advantages to doing so.

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[9] Ronald S. Burt, *Corporate Profits and Co-optation*, New York: Academic Press, 1983.

[10] See, for instance, Jeffrey Pfeffer and Gerald R. Salancik, *The External Control of Organizations: A Resource Dependence Perspective*, New York: Harper and Row, 1978.

[11] Morten T. Hansen, Joel M. Podolny, and Jeffrey Pfeffer, "So Many Ties, So Little Time: A Task Contingency Perspective on Corporate Social Capital in Organizations," pp. 21-57 in Shaul M. Gabbay and Roger Leenders (eds.), *Research in the Sociology of Organizations, Vol. 18*, Amsterdam: Elsevier, 2001.

Third, different types of projects and tasks are helped or hindered by different network structures—a network rich in structural holes and a large such network is not necessarily always advantageous. Weak ties are less useful for transferring tacit knowledge. And larger networks take time and effort to build and maintain and, therefore, are only useful to the extent that the particular task requires accessing knowledge or assistance that needs to come from others. And finally, it is absolutely clear that jobs vary in the extent to which success depends on the substantive knowledge and performance of more technical tasks compared to the ability to build numerous relationships and bridge many structural holes. One should pick positions, therefore, with one's skills and interests in networking in mind. And in a similar vein, if someone occupies a position where bridging and brokerage are critical skills, developing such skills will be comparatively more important for career success.