

A SOCIAL NETWORK PERSPECTIVE ON INDUSTRIAL/ORGANIZATIONAL PSYCHOLOGY

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ABSTRACT

This paper applies a social network perspective to the study of industrial/organizational psychology. Complementing the traditional focus on individual attributes, the social network perspective focuses on the relationships among actors. The perspective assumes that actors (whether they be individuals, groups, or organizations) are embedded within a network of interrelationships with other actors. It is this intersection of relationships that defines an actor's position in the social structure, and provides opportunities and constraints on behavior. A brief introduction to social networks is provided, and research focusing on the antecedents and consequences of networks is reviewed. The social network framework is applied to organizational behavior topics such as recruitment and selection, performance, power, and leadership, with a focus on research results obtained and directions for future research.

I am indebted to Steve Borgatti, Joe Labianca, Ajay Mehra and the other faculty and Ph.D. students at the Links Center for the many interesting and insightful discussions that form the basis for chapters such as this. Equally helpful have been dialogs over the years with my network colleagues and long-time friends Martin Kilduff and David Krackhardt.

INTRODUCTION

In the fall of 1932, the Hudson School for Girls in upstate New York experienced a flood of runaways in a two-week period of time. The staff, who thought they had a good idea of the type of girl who usually ran away, was baffled trying to explain the epidemic. Using a new technique that he called “sociometry,” Jacob Moreno graphically showed how the girls’ social relationships with each other, rather than the personalities or motivations, resulted in the contagious runaways (Moreno, 1934). More than 50 years later, Krackhardt and Porter (1986) showed how turnover occurred among clusters of friends working at fast-food restaurants.

During the 1920s, the researchers of the famous Hawthorne studies at the Western Electric Plant in Chicago diagramed the observed interaction patterns of the workers in the bank wiring room. Their diagrams resembled electrical wiring plans and showed how the informal relationships were different from the formally prescribed organizational chart. Today, many studies have investigated employee interaction patterns in organizations (see Brass, Galaskwietz, Greve, and Tsai, 2004, for a review).

What these studies have in the common is a focus on the relationships among people in organizations, rather than attributes of the individuals. It is, of course, highly appropriate that the study of organizational behavior in fact focuses on the attributes of individuals in organizations; and, it is to the credit of my industrial/organizational psychology friends that so much progress has occurred. However, to focus on the individual in isolation, to search in perpetuity for the elusive personality or demographic characteristic that defines the successful employee is, at best, failing to see the entire

picture. At worst, it is misdirected effort continued by the overwhelming desire to develop the perfect measurement instrument. There is little doubt (at least in my mind) that the traditional study of industrial/organizational psychology (or organizational behavior) has been dominated by a perspective that focuses on the individual or the organization in isolation. We are of course continually reminded of the need for an interactionist perspective: that the responses of actors are a function of both the attributes of the actors and their environments. Even with attempts to match the individual with the organization, the environment is little more than a context for individual interests, needs, values, motivation, and behavior.

I do not mean to suggest that individuals do not differ in their skills and abilities and their willingness to use them. I too revel in the tradition of American individualism. I will not suggest that individuals are merely the “actees” rather than the actors (Mayhew, 1980). Rather, I wish to suggest an alternative perspective, that of social networks, that does not focus on attributes of individuals (or of organizations). The social network perspective instead focuses on relationships rather than (or in addition to) actors (the links rather than the nodes). It assumes that social actors (whether they be individuals, groups, or organizations) are embedded within a web (or network) of interrelationships with other actors. It is this intersection of relationships that defines an individual’s role, an organization’s niche in the market, or simply an actor’s position in the social structure. It is these networks of relationships that provide opportunities and constraints, that are as much, or more, the causal forces as the attributes of the actors.

Given the rapid rise of social network articles in the organizational journals, it may be unnecessary to familiarize readers with basics (Borgatti & Foster, 2003).

However, the popularity has caused confusion and threatened the coherence of the approach. I begin with a brief, general primer on social networks, including tables that illustrate the various social network measures typically used in organizational behavior research. I will not begin at the beginning; excellent histories of social network analysis are available (see Freeman, 2004), nor will I attempt to reference every social network article that has ever appeared in an organizational behavior journal. Reference to my own work is more a matter of familiarity than self-promotion. I will focus on the design of social network research with attention to findings regarding the antecedents and consequences of social networks from an interpersonal perspective (a micro approach) with only occasional references to inter-organizational research when appropriate. I attempt to note the research that has been done and suggest directions for future research, also noting the criticisms and challenges of this approach. My overall goal is to provide readers enough information to conduct social network research and enough ideas to encourage research on social networks in organizational behavior.

SOCIAL NETWORKS

Although many intuitive definitions exist, I define a network as a set of nodes and the set of ties representing some relationship or lack of relationship between the nodes. In this most abstract definition, networks can be used to represent many different things, resulting in the adoption of the perspective across a wide range of disciplines (see Borgatti, Mehra, Brass, & Labianca, 2009). Even researchers in the hard sciences of physics and biology have applied networks to their favorite theories. Thus, we find no universal theory of networks. Rather, we find a perspective that applies many of network concepts and measures to a variety of theories.

In the case of social networks, the nodes represent actors (i.e., individuals, groups, organizations). Actors can be connected on the basis of 1) similarities (same location, membership in the same group, or similar attributes such as gender), 2) social relations (kinship, roles, affective relations such as friendship, or cognitive relations such as knows about), 3) interactions (talks with, gives advice to), or 4) flows (information) (Borgatti et al. 2009). In organizational behavior research, the links typically involve some form of interaction, such as communication, or represent a more abstract connection, such as trust, friendship, or influence. They may also be used to represent physical proximity or affiliations in groups, such as CEOs who sit on the same boards of directors (e.g., Mizuchi, 1996). Although the particular content of the relationships represented by the ties is limited only by the researcher's interest, typically studied are flows of information (communication, advice) and expressions of affect (friendship). I will refer to a focal actor in a network as "ego;" the other actors with whom ego has direct relationships are called "alters."

Although the dyadic relationship is the basic building block of networks, dyadic relationships have for many years been studied by social psychologists. The idea of a network (if not the technical graph-theoretic definition) implies more than one link. Indeed, the added value of the network perspective, the unique contribution, is that it goes beyond the dyad and provides a way of considering the structural arrangement of many nodes. The unit of analysis is not the dyad. As Wellman (1988) notes, "It is not assumed that network members engage only in multiple duets with separate alters." Indeed, it might be said that the triad is the basic building block of networks (Simmel, 1950; Krackhardt, 1998). The focus is on the relationships among the dyadic

relationships (i.e., the network). Typically, a minimum of two links connecting three actors is implicitly assumed in order to have a network and establish such notions as indirect links and paths.

The importance of indirect ties and paths is illustrated in Travers and Milgram's (1969) experimental study of "the small world problem." They asked 296 volunteers in Nebraska to attempt to reach by mail a target person living in the Boston area. They were instructed, "If you do not know the target person on a personal basis, do not try to contact him directly. Instead, mail this folder to a personal acquaintance who is more likely than you to know the target person." Recipients of the mailings were asked to return a postcard to the researchers and to mail the folder on to the target (if know personally) or someone more likely to know the target. Of the folders that eventually reached the target, the average number of intermediaries (path length) was approximately six, leading to the notion of "six degrees of separation" and the common expression, "It's a small world" (see Watts, 2003 for a more refined and updated thesis on small worldness).

Closely connected to the assumption of the importance of indirect ties and paths, is the assumption that something (often information, influence, or affect) is transmitted or flows through the connections. Although other mechanisms for explaining the results of network connections have been provided (Borgatti et al., 2009), most organizational researchers explain the outcomes of social networks by reference to flows of resources. For example, a central actor in the network may benefit because of access to information. Podolny (2001) coined the term "pipes" to refer to the "flow" aspect of networks, but also noted that networks can serve as "prisms," conveying mental images of status, for example, to observers.

The final assumption of most social network research is that the network provides the opportunities and constraints that affect the outcomes of individuals and groups. Often included is the assumption that these linkages as a whole may be used to interpret the social responses of the actors (Mitchell, 1969). While this assumption does not exclude the possible causal effects of human capital, it assigns primacy to network relationships and leads logically to the concept of social capital.

Social Capital

As differentiated from human capital (an individual's skills, ability, intelligence, personality, etc.) or financial capital (money), the popularized concept of social capital refers to benefits derived from relationships with others. The task of precisely defining and measuring social capital has received much attention and resulted in considerable disagreement (see Adler & Kwon, 2002 for a cogent discussion of the history of usage of the term). Definitions have generally followed two perspectives. One perspective focuses on individuals and how they might access and control resources exchanged through relationships with others in order to gain benefits or acquire social capital. This approach is exemplified by the studies that suggest that an actor's (individual's, group's, organization's) position in the network provides benefits to the actor. Burt's (1992) work on the advantages of "structural holes" in one's network (ego is connected to alters who are not themselves connected) is an example. The other perspective focuses on the collective and assesses how groups of actors collectively build relationships that provide benefits to the group. This approach is exemplified by Coleman's (1990) often cited reference to social capital as norms and sanctions, trust, and mutual obligations that result from "closed" networks (a high number of interconnections between members of a group;

ego's alters are connected to each other). Putnam's (1995) "Bowling Alone" work on the demise of social capital in U.S. is another example of this collective approach. Putnam's statistics show a steady decline in membership in bowling leagues, bridge clubs, and community and church groups since the 1950s. The collective, group-level approach does not forgo the individual entirely, as it suggests how collective social capital may benefit the individual members of the group as well as the group. Indeed, both approaches suggest individual and group level benefits.

The difference in the focus is amplified by seemingly contradictory predictions concerning the acquisition of social capital. At the individual level, connecting to disconnected others results in social capital; at the collective level, connecting to others who are themselves connected results in closure in the network and the social capital associated with trust, norms, and group sanctions. Such networks can provide social support and a sense of identity. However, one can be "trapped in your own net" as closed networks can constrain action (Gargiulo & Benassi, 2000). Indeed, both approaches are based on the underlying network proposition that densely connected networks constrain attitudes and behavior. In one case (Coleman, 1990; Putnam, 1995), this constraint promotes good outcomes (trust, norms of reciprocity, monitoring and sanctioning of inappropriate behavior); in the other case (Burt, 1992) constraint produces bad outcomes (redundant information, a lack of novel ideas). When the network is extended outward (enlarged) it is typically the bridges (structural hole positions) that provide the closure for the larger network.

Attempts have been made both to test one approach versus the other as well as to reconcile both approaches (Burt, 2005). However, as Lin (2001: 8) points out, “Whether social capital is seen from the societal-group level or the relational (individual) level, all scholars remain committed to the view that it is the interacting members who make the maintenance and reproduction of this social asset possible.” Nahapiet & Ghoshal, (2000: 243) offer a comprehensive definition: “The sum of the actual and potential resources embedded within, available through, and derived from the network of relationships possessed by an individual or social unit.” One can view social capital, like other forms of capital, from an investment perspective with the expectation of future (often times uncertain) benefits (Adler & Kwon, 2002). We invest in relationships with the hoped-for return of benefits. These benefits may be in the form of human capital, financial capital, physical capital, or additional social capital.

Some network researchers have dismissed the definitional battles surrounding social capital as irrelevant to their research. They note that the definitions have become so broad as to be meaningless. As Coleman (1990) notes, social capital is like a “chair” – it comes in many different shapes and sizes but is defined by its function. And it is important to note that much social network research focuses on how actors become similar (e.g., diffusion studies), rather than on how actors differentially benefit from networks. Nevertheless, the seemingly contradictory hypotheses of structural holes versus closure has generated a furious deluge of research. In addition, the concept of social capital has provided a legitimizing label that reinforces many of the underlying assumptions of social network analysis.

Social Network Approaches and Measures

Social network research can be categorized in many ways; I choose to organize around four approaches or research foci: 1) structure, 2) relationships, 3) resources, and 4) cognition. To these four, I add the traditional organizational behavior focus on the attributes of actors and note that these approaches can, and often are combined (e.g., Seibert, Kraimer, & Liden, 2001). Associated with each approach, I list network measures that have typically been used in organizational research.

Focus on structure. Consider the diagrams in Figure 1. One does not need to be an expert on social networks to suggest that the center node (position A) in Figure 1a is the most powerful position. When shown this simple picture, few people ask whether the nodes represent individuals or groups, or whether the lines represent communications, friendship, or buy-sell transactions. Nor does anyone ask if the lines are of differing strengths or intensities, or whether they represent directional, repeated, or symmetric interactions. Most people simply look at the diagram and declare that node A is the most powerful. Likewise, almost everyone would agree that the network in 1a is more centralized than the decentralized network represented in 1b.

Insert figure 1 about here.

We make these judgments based simply on the pattern or structure of the nodes and ties. That is, Figure 1 provides no information other than the structural arrangement of positions. We do not know the values, attitudes, personality, or abilities of any of the nodes. We do not know if the nodes represent individuals, groups, or organizations (although you probably assumed they represented social entities). From a purely structural perspective, a tie is a tie is tie, and a node is a node is a node, (only

differentiated on the basis of its structural position in the network). It is the *pattern* of relationships that provide the opportunities and constraints that affect outcomes.

The structural focus is at the heart of social network analysis, and the abstract nature of patterns of nodes and ties have led to the wide application of networks to a variety of different disciplines. It has also led to a search for universal patterns that may be applied to such diverse topics as atoms and molecules, transportation networks, and electrical grids. For example, researchers have noted small-world patterns (dense clusters connected by a few number of bridges) in nematodes, electrical power transmission systems, and Hollywood actors (Watts, 2003).

A purely structural explanation for the advantage of A over the other nodes in Figure 1a would simply note that A is the most central position in the network. Period. However, purely structural explanations are rarely acceptable to reviewers for organizational behavior journals (for the extreme structural perspective, see Mayhew, 1980). Rather, reviewers and authors exhibit a tendency toward reductionism and theoretical explanations based on human agency. These tendencies represent a metaphysical preference, masquerading as a debatable point (Mehra, 2009).

In explaining their choice in figure 1a, most people could articulate an intuitive notion of centrality. They might suggest that position A is at the “center” of the group, that position A has access to all the other positions, or that the other positions are dependent on position A; that is, they must “go through” position A in order to reach each other. They might conclude that position A controls the group; A is not dependent on any one other node, and all the other nodes are dependent on A. Thus, most people have an intuitive idea of what social networks are, what centrality is, and how both might

relate to power. Consequently, few people would be surprised to learn that their intuitive prediction has been supported in a number of settings (see Brass, 1992).

Table 1 presents typical measures used to describe structural positions in the network. It is important to keep in mind that these measures are not attributes of isolated individual actors; rather, they represent the actor's relationship within the network. If any aspect of the network changes, the actor's relationship within the network also changes.

Insert Table 1 about here.

In addition to describing positions within the network, several structural measures have been developed to describe the entire network. For example, network 1a could be described as more centralized than network 1b. Some typical structural measures used to describe entire networks are listed in Table 2.

Insert Table 2 about here.

Structural measures have also been developed for identifying groups or clusters of nodes (actors) within the network. For example, a network is sometimes described as having single or multiple components (all nodes in a component are connected by either direct or indirect links). That is, any actor in a component can reach all other actors in the component directly or through a path of indirect ties. One large component is typical of networks within organizations.

There are two typical methods of grouping actors within components, a relational method often called *cohesion*, and a structural method referred to as *structural equivalence*. The relational cohesion approach clusters actors based on their ties to

each other. For example, a clique is a group of actors where every actor is connected to every other actor (network 1b represent a clique). Other measures have been developed to relax the clique criteria for grouping actors. For example, n-clique groups all actors who are connected by a maximum of n links. A k-plex is a group of actors in which each actor is directly connected to all except k of the other actors.

The structural equivalence approach is based on the notion that actors may occupy similar positions within the network structure, although they may not be directly connected to each other. For example, two organizations in the same industry may have similar patterns of links to suppliers and customers but may not have any direct connection between themselves. The two organizations are said to occupy similar structural positions in the network; that is, to be structurally equivalent. In a communication network, structurally equivalent actors may communicate with similar others but not necessarily communicate with each other. In network 1a, actors B, C, D, and E are structurally equivalent. A technique called blockmodeling is used to group actors on the basis of structural equivalence (DiMaggio, 1986).

Because actors in organizations are typically formally grouped via hierarchy and work function, it is difficult to find organizational behavior research that uses network measures to group people. For an extensive and detailed description of grouping measures, see Scott (2000: 100-145) or Wasserman and Faust (1994: 249-423).

Focus on Relationships. Rather than assuming that all relationships are the same (a tie is a tie is a tie), social network researchers often attempt to differentiate the ties. Focusing on the content of the relationships (what type of tie the lines in the network diagram represent) is a boundary specification issue (see below). Rather than focus on

the particular content, several other ways to characterize the links have been measured by social network researchers. While the structural approach typically treats ties as binary (present or absent) and directional (ego seeks advice from alter), the focus on relationships typically assigns values to ties (such as frequency or intensity). Table 3 indicates typical measures of links, or ties. Although each of the measures in Table 3 can be used to describe a particular link between two actors, the measures can be aggregated and assigned to a particular actor or used to describe the entire network. For example, we might note that 30% of actor A's ties are symmetric, or 50% are strong ties. For the entire network, we might note that 70% of all ties are reciprocated, or that 40% of the ties are multiplex.

Insert Table 3 about here.

The focus on relationships in social networks has been dominated by Granovetter's (1973) theory of the "the strength of weak ties." Granovetter argued that job search is embedded in social relations which he defined as strong or weak ties. Tie strength is a function of time, intimacy, emotional intensity (mutual confiding), and reciprocity (Granovetter, 1973: 348). Strong ties are often characterized as friends and family; weak ties are acquaintances. Granovetter found that the weak ties were more often the source of helpful job information than strong ties.

Although the research exemplified the primacy of social relations, it was Granovetter's structural explanation for the "strength of weak ties" that generated research interest in networks. Focusing on the indirect ties in the network, Granovetter argued that strong ties tend to be themselves connected (part of the same social circle) and provide the job seeker with redundant information. Weak ties, on the other hand,

tend to not be connected themselves; they represent ties to disconnected social circles (bridges) that provide more useful, non-redundant information in finding jobs. Thus, "social structure can dominate motivation" (Granovetter, 2005: 34). While strong-tie friends may be more motivated to help than weak-tie acquaintances, it is likely to be acquaintances who provide information concerning new jobs. Although subsequent research refined and modified these results (c.f., Bian, 1997; Lin, 1999; Wegener, 1991), Granovetter's notion that weak ties can be useful bridges connecting otherwise disconnected social circles is one of the most referenced ideas in the social sciences.

Strong ties have also received research attention as they are often thought to be more influential, more motivated to provide information, and of easier access than weak ties. For example Krackhardt (1992) showed that strong ties were influential in determining the outcome of a union election. Hansen (1999) found that while weak ties were more useful in searching out information, strong ties were useful for the effective transfer of information. Uzzi (1997) found that "embedded ties" were characterized by higher levels of trust, richer transfers of information and greater problem solving capabilities when compared to "arms-length" ties. On the downside, strong ties require more time and energy to maintain and come with stronger obligations to reciprocate.

In addition, negative ties have recently drawn research attention (Labianca & Brass, 2006). Defined as "dislike," "prefer to avoid," or "difficult to work with," negative ties represent social liabilities. Further, research on negative asymmetry suggests that negative relationships may be more powerful predictors of outcomes than positive relationships. For example, Labianca, Brass and Gray (1999) found that positive

relationships (friends in the other groups) were not related to perception of intergroup conflict, but negative relationships were (someone disliked in the other group).

Focus on resources. Rather than assume that all nodes (in particular, alters) are the same, some social network researchers have focused on the resources of alters. Lin (1999) has argued that tie strength and the disconnection among alters is of little importance if the alters do not possess resources useful to ego. In response to Granovetter's (1973) findings, Lin, Ensel, & Vaughn (1981) found that weak ties reached higher status alters and that alters' occupational prestige was the key to ego obtaining a high status job. Lin (1999) reviews research supporting this resource-based approach to status attainment across a variety of sample in different countries. While a more complete focus might address the complementarity of ego and alters' resources, this approach has primarily relied on status indicators. For example, Brass (1984) found that links to the dominant coalition of executives in a company were related to power and promotions for non-managerial employees.

Focus on attributes. As Kilduff and Tsai (2003: 68) note, the study of individual attributes "calls forth various degrees of scorn and dismissal from network researchers." In carving out their structural niche, network researchers have largely ignored individual attributes with the exception of controlling for various demographic characteristics such as gender. Similarly, the effects of human agency in emerging networks and the ability or motivation of individuals to take advantage of structural positions is missing from most network research. From a structural perspective, individual characteristics such as personality are the result of an historical accumulation of positions in the network structure. Thus, there is ample opportunity for research that investigates how individual

characteristics affect network structure (e.g., Mehra, Kilduff & Brass, 2001) or how individual abilities and motivations might interact with the opportunities and constraints presented by network structures (e.g., Zhou, Shin, Brass, Choi, & Zhang, 2009). Rather than arguing about the relative importance of structure and agency, it may be more useful to determine which structures maximize individual agency. While the centralized structure in network 1a presents a strong situation and an easy structural prediction, it is difficult to predict the most powerful node in network 1b without reference to individual attributes.

Focus on cognition. Rather than viewing networks as “pipes” through which resources flow, the cognitive approach to social networks has focused on networks as “prisms.” As reported by Kilduff and Krackhardt (1994), when approached for a loan, the wealthy Baron de Rothschild replied, “I won’t give you a loan myself, but I will walk arm-in-arm with you across the floor of the Stock Exchange, and you will soon have willing lenders to spare.” (Cladini, 1989: 45). As exemplified by this quote, the cognitive approach to networks focuses on individuals’ cognitive interpretations of the network. Kilduff and Krackhardt (1994) found that being perceived to have a prominent friend had more effect on one’s reputation for high performance than actually having a prominent friend in the organization. Likewise, Podolny (2000) notes how the market relations between firms are not only affected by the transfer of resources, but also by how third parties perceive the quality of the relationship. You are known by the company you keep. But, cognitive interpretations are not only made by third party observers, relationships hinge on the cognitive interpretations of actions by the parties involved. For example, we are not likely to form relationships with people whom we perceive as trying

to use us. Calculated self-interest in building relationships, if perceived, is self defeating. Brokers may be perceived as less trustworthy than closely connected members of the groups they connect. I also include in this category studies that focus on individual's mental maps of networks (e.g., Krackhardt, 1990). The focus on cognition also poses the question of whether the enhanced awareness of social networks (through social networking sites such as Facebook and management consultants offering network workshops) may alter the way people form, maintain, and terminate ties. Such awareness also challenges self-reports as valid sources of network data. Kilduff and Tsai (2003) and Kilduff and Krackhardt (2008) provide more extended discussion of cognition and networks. .

METHODOLOGICAL ISSUES

Social network data may be collected from archival records (inter-organizational alliance, e-mail, membership in groups), observations, informant perceptions (interviews or questionnaires), or a combination of these methods. While archival records provide accuracy, it is often difficult to determine what is being exchanged or how to interpret the ties. Observation is very time consuming and the chances of missing an important link or misinterpreting an interaction are high. At the interpersonal level, most organizational behavior researchers have used questionnaires to obtain self-reports from actors. People are asked whom they talk with, trust, are friends with, etc. Although research has shown that people are not very accurate in reporting specific interactions (Bernard, Killworth, Kronenfeld, & Sailer, 1984), reports of typical, recurrent interactions are reliable and valid (Freeman, Romney, & Freeman, 1987).

People can be asked to *list* the names of alters in response to name generators or asked to select their alters from a *roster* of all names in the network of interest. While the list method relies on people remembering all important alters and having the time and motivation to list them all, the roster method assumes that the researcher can identify all possible alters prior to data collection. People are more likely to remember their strong ties so the roster method may be preferable when attempting to tap weak ties, and vice versa. The roster method will almost always result in larger reported networks.

Researchers can collect *ego network* data (typically used when sampling unrelated egos from a large population) or *whole network* data (typically used when collecting data from every ego within a specified network such as one particular organization). An ego network consists of ego, his direct-link alters, and ties among those alters. Ego is typically asked to list his direct-link alters and to indicate whether the alters are themselves connected. Such data is limited by ego's ability to accurately describe the connections among direct-tie alters, and many of the structural network measures cannot be applied to ego network data (i.e., centrality). No attempt is made to collect data on path lengths beyond direct-tie alters. Whole network data consists of archival, observational, or informant reports of all nodes and ties within a specified network (e.g., all organizational alliances within an industry, all friendship relations among employees within a group or an organization). All participants are asked to report their direct ties and all reports are combined to form the whole network. While the whole network approach does not rely on a single informant and allows the researcher to calculate extended paths and additional structural measures, the danger arises from the possibility of mis-specifying the network (important nodes and links are not included).

Boundary Specification. If it is indeed a small world, bounding the network for research purposes is an important, if seldom addressed, issue. Given the research question, what is the appropriate membership of the network? This involves specifying the number of different type networks to include as well as the number of links removed from ego (indirect links) that should be considered. Both decisions have conceptual implications as well as methodological.

In organizational research, formal boundaries exist: work groups, departments, organizations, industries. Seldom have researchers even addressed the issue of how many links (direct and indirect) to include as the network may extend well beyond ego's direct ties. The importance of this boundary specification is emphasized by Brass' (1984) finding that centrality within departments was positively related to power and promotions while centrality within the entire organization produced a negative finding. However, the appropriate number of links has recently garnered renewed attention with the publication of Burt's (2007) findings. He found that second-hand brokerage (structural holes beyond ego's local direct-tie network) did not significantly add to variance in outcomes in three samples from different organizations, justifying his use of data focusing on ego's local, direct-tie network (ego network data). Unlike sexually transmitted diseases, information in organizations tends to decay across paths and including ties three or four steps removed from ego may be unnecessary. As Burt (2007) notes, people may not have the ability or energy to think through the complexity of brokerage in an extended network. He also notes that his results are limited to the brokerage-performance relationship, as several examples exist of the importance of third-party ties (two-steps removed from ego): Bian (1997) in finding jobs, Gargiulo (1993) in gaining two-step leverage;

Labianca, Brass, and Gray (2001) in perceptions of conflict, and Bowler and Brass (2006) in organizational citizenship behavior.

Whole network measures of structural holes (accounting for longer paths) also have been shown to be significant in predicting power and promotions (Brass, 1984; 1985) and performance (Mehra, Kilduff & Brass, 2001), although Burt (2007) suggests these results may hinge on a strong relationship between direct-tie brokerage and extended brokerage. Although experimental studies of exchange networks have shown that an actor's structural hole power to negotiate (play one alter off against the other) is significantly weakened if the two alters each have an additional link to an alternative negotiating partner (Cook, Emerson, Gilmore, & Yamagishi, 1983), Brass and Burkhardt (1992) found no evidence of this effect in a field study. In sum, there is considerable evidence for both a local and the more extended network approach, and it is likely that debate will ensue and continue. Including the appropriate number of links is likely a function of the research question and the mechanism involved in the flow, but assuredly, researchers will need to attend to and justify their boundaries more explicitly in the future.

The conceptual implications concern the issue of structural determinism and individual agency. Direct relationships are jointly controlled by both parties and motivation by one party may not be reciprocated. If important outcomes are affected by indirect links (over which ego has even less control), the effects of agency become inversely related to the path distance of alters whose relationships may affect ego. Structural determinism increases to the extent that distant relationships affect ego.

Identifying the domain of possible types of relationships (network content) is equally troublesome. Burt (1983) noted that people tend to organize their relationships around four categories: friendship, acquaintance, work, and kinship. Types of networks (the content of the relationships) are sometimes classified as informal versus formal, or instrumental versus expressive (Ibarra, 1992). However, interpersonal ties often tend to overlap and it is sometimes difficult to exclusively separate ties on the basis of content.

Conceptually, the issue is one of appropriability. Coleman (1990) included appropriability as a key concept in his notion of social capital. That is, one type of tie may be appropriated for a different type of use. For example, a friendship tie might be used to secure a financial loan, or sell Girl Scout cookies. Indeed, Granovetter's (1985) critique of economics argued that economic transactions are embedded in, and affected by networks of interpersonal relationships (see also Uzzi, 1997). Although the concept of "embeddedness" has been confused in a number of ways, the idea that different types of relationships overlap and that one type of tie may be appropriated for another use casts doubt on the notion that different types of networks produce different outcomes. If different ties are appropriable, the danger of focusing on only one network is that important ties may be missing from the data. Thus, researchers like Burt (1992) typically measure several different types of content and aggregate across content networks. On the other hand, Podolny and Baron (1997) suggest different outcomes from different types of networks. The obvious exception to appropriability is negative ties – when one person dislikes another (Labianca & Brass, 2006). Centrality in a conflict network will certainly lead to different results than centrality in a friendship network.

Levels of analysis. The claim is often made that a social network perspective integrates micro and macro approaches to organizational studies (Wellman, 1988). Consistent with this claim is the advantage it offers of simultaneously studying the whole as well as the parts. As Table 2 illustrates, the dyadic relationships are measured in a variety of ways, and are used to compose the network. They are, in a sense, the parts that form the whole, and, as Table 1 shows, we can assign network properties to individual actors. These measures are inherently cross-level as they combine actor and network. They represent the relative position of a part within the whole. In addition, actors can be clustered (based on their relationships within the network) into groups or cliques. Thus, researchers can simultaneously address actor, group of actors, and network characteristics. For example, a researcher might ask, to what extent does an actor's centrality within a highly central clique in a decentralized network affects that actor's power? Although possible, such analyses have rarely been undertaken.

Brieger (1988) notes that when two people interact, they not only represent themselves, but also any formal or informal group/organization of which they are a member. Thus, individual interaction is often assumed to also represent group interaction. For example, CEOs who sit on the same boards of directors are assumed to exchange information that is subsequently diffused through their respective organizations and affects organization outcomes (e.g., Galaskiewicz & Burt, 1991). While the assumptions are not directly tested (Zaheer & Soda, 2009), they provide a convenient compositional model for moving across levels of analysis.

SOCIAL NETWORK THEORY

Despite reference to an amorphous “social network theory” in the management literature, perhaps the most frequent criticism of the approach is that it represents a set of techniques and measures devoid of theory (but see Borgatti & Lopez-Kidwell, 2010). Just as Tables 1, 2, and 3 illustrate, it is often easier to catalog the measures than to provide a theoretical explanation for the emergence and persistence of social networks. More often, the measures are used to operationalize constructs suggested by the researcher’s favorite theory. Rather than a weakness, the development of sophisticated measures of social structure is a distinctive strength of social network analysis that has allowed researchers from many different disciplines to mathematically represent concepts that were previously only loose metaphors (Wellman, 1988). In the chronology of networks, the first step was to develop mathematical measures to represent structural patterns. Such measures abound and new measures are consistently being developed. For example, the social network software program UCInet (Borgatti, Everett, & Freeman, 2002) includes nine different measures of the concept of positional centrality. With the measures in hand, it was then necessary to show that they relate to important outcomes. Without this step, it made little sense to investigate the emergence of networks (antecedents) or how networks develop and change over time.

As Wellman (1988) noted, social networks have been often synonymous with the structural paradigm in anthropology and sociology. Social networks have been often equated with, or used to represent, social structure. Behavior, attitudes, norms, status, and so forth, have been interpreted in terms of the structure rather than the inherent properties of the actors. Similar structures produce similar outcomes. At the extreme, “the pattern of relationships is substantially the same as the content” (Wellman, 1988, p. 25). Without

adopting this extreme position, it is nevertheless appropriate to look to a theory such as structuration (Giddens, 1976) to provide a general basis for understanding social networks.

I begin with the simple observation that people interact and communicate, and assume that all interaction involves communication, be it intended or unintended. Interaction can be purposeful, coincidentally random, or forced or constrained by factors external to the actors. Various reasons have been offered for why people interact (e.g., to satisfy social as well as other needs, to obtain desired outcomes, and so forth.) In a general sense, let me summarize these reasons by assuming that people interact in order to make sense of, and successfully operate on their environment. As Darwin noted, survival may have gradually nudged humans toward cooperative groups based on their ability to divide up the labor and help each other. When the interaction is helpful in this regard, the interaction continues and a relationship is formed. Although initial interaction may be random, repeated interaction is not.

Repeated interaction leads to social structure. As Barley (1990) notes, "...while people's actions are undoubtedly constrained by forces beyond their control and outside their immediate present, it is difficult to see how any social structure can be produced or reproduced except through ongoing action and interaction" (pp. 64-65). Thus, I define social structure as representing relatively stable patterns of behavior, interaction, and interpretation. These patterns emerge, and become institutionalized as recurrent interaction over time takes on the status of predictable, socially shared regularities, that is, "taken-for-granted facts" (Barley, 1990, p. 67). People then behave within these institutionalized patterns as if these structures were external to, and a constraint upon

their interaction. The constrained behavior in turn underwrites and reinforces the observed and socially shared structural patterns. These shared structural patterns also facilitate interaction, just as language facilitates communication.

However, just as everyday speech reinforces the grammatical rules of language, it also gradually modifies the language as new words and syntax are used and re-used, and eventually are incorporated as acceptable additions. In the same sense, interactions which occur within the constraints of structure can gradually modify that structure. For example, those persons disadvantaged by the current structural constraints may actively seek to change them, or exogenous shocks may provide the occasion for major restructuring.

I am attempting to merge the micro and the macro, the individual and the structure. Thus, I do not ignore individual agency nor the structural constraints which may at times render it useless. Structure and behavior are intertwined, each affecting the other. Thus, I proceed to explore the antecedents and outcomes of networks in relation to organizations. I underscore the dynamic nature of structuration theory, noting that distinctions between causes and outcomes are often nonexistent.

SOCIAL NETWORKS: ANTECEDENTS

Spatial, Temporal, and Social Proximity

Although the advent of e-mail and social networking sites such as Facebook may moderate the effects of proximity on relationships, the same might have been said for telephones. However, being in the same place at the same time fosters relationships that are easier to maintain and more likely to be strong, stable links (Brogatti & Cross, 2003; Festinger, Schacter, and Back, 1950; Fulk & Steinfield, 1990; Monge & Eisenberg, 1987).

In addition to spatial and temporal proximity, social proximity also fosters relationship. That is, a person is more likely to form a relationship with an alter two links removed (e.g., acquaintance of a friend) than three or more links removed. To the extent that organizational workflow and hierarchy locate employees in physical and temporal space, we can expect additional effects on social networks. Because it would be difficult for a superior and subordinate directly linked by the formal hierarchy to avoid interacting, it would not be surprising for the “informal” social network to shadow the formal hierarchy of authority (or workflow). For example, Tichy and Fombrun (1979) found higher density and connectedness in the interpersonal interaction network in an organic organization than a mechanistic organization. Similarly, in a study of 36 agencies Shrader, Lincoln, and Hoffman (1989) found that organic organizations were characterized by networks of high density, connectivity, multiplexity, and symmetry, and a low number of clusters. Confirming this intuition, Burkhardt and Brass (1990) and Barley (1990) found that communication patterns in an organization changed when the organization adopted a new technology.

Homophily

Spatial, temporal, and social proximity provide opportunities to form relationships, but we do not form relationships with everyone we meet. Social psychologists and sociologists are quite familiar with homophily: a preference for interaction with similar others. A good deal of research has supported this proposition, and it is a basic assumption in many theories (see McPherson, Smith-Lovin & Cook, 2001, for a cogent review). Similarity has been operationalized on such dimensions as race and ethnicity, age, religion, education, occupation, and gender (roughly in order of

importance). People can be similar on many different dimensions. Distinctiveness theory suggests that the salient dimension is the one most distinctive relative to others in the group (Mehra, Kilduff & Brass, 1998). As McPherson, Smith-Lovin and Cook (2001: 415) summarize, similarity breeds connections of every type: marriage, friendship, work, advice, support, information transfer, and co-membership in groups. “The result is that people’s personal networks are homogeneous with regard to many socio-demographic, behavioral, and interpersonal characteristics.” Similarity is thought to ease communication, increase predictability of behavior, foster trust and reciprocity, and reinforce self-identity. Using electronic name-tags to trace interactions at a business mixer, Ingram & Morris (2007) found evidence of associative homophily: a tendency to join conversations when someone in the group was similar. We would expect the characteristics of the links between actors to be related to the degree of actor similarity. Interaction between two dissimilar actors is likely to be infrequent, not reciprocated, less salient to either, asymmetric, unstable, uniplex rather than multiplex, weak, and decay more quickly. Similarity of actors also may be positively related to the density or connectedness of the network. Relative homophily is not a perfect predictor of relationships as similarity can also lead to rivalry for scarce resources, and differences may be complementary and combined for successful outcomes. Exceptions can also occur as people aspire to make connections with higher status alters. However, there is little incentive for the higher status person to reciprocate, absent homophily on other characteristics. For example, Brass and Burkhardt (1992) found that interaction patterns were correlated with similar levels of power.

Focusing on gender homophily, Brass (1985a) found two largely segregated networks (one predominately men, the other women) in an organization. Ibarra (1992) also found evidence for homophily in her study of men's and women's networks in an advertising agency. In distinguishing types of networks, she found that women had social support and friendship network ties with other women, but they had instrumental network ties (e.g., communication, advice, influence) with men. Men, on the other hand, had homophilous ties (with other men) across multiple networks, and these ties were stronger. Gibbons and Olk (2003) found that similar ethnic identification led to friendship and similar centrality. Perceived similarity (religion, age, ethnic and racial background, and professional affiliation) among executives has been shown to influence interorganizational linkages (Galaskiewicz, 1979). Although social network measures were not included, research on relational and organizational demography (e.g., Williams & O'Reilly, 1998) have employed the similarity/attraction assumptions. We also would expect similarity of personality and ability to be related to the interpersonal network patterns of interaction.

Due to culture, selection, socialization processes, and reward systems, an organization may exhibit a modal demographic or personality pattern. Kanter (1977) has referred to this process as "homosocial reproduction," consistent with attraction-selection-attrition research (Schneider, Goldstein, & Smith, 1995). Thus, an individual's similarity in relation to the modal attributes of the organization (or the group) may determine the extent to which he or she is central or integrated in the interpersonal network. This suggests that minorities may be marginalized. Mehra, Kilduff, and Brass (1998) found this to be the case in an MBA class.

The above discussion implies that interaction in organizations is emergent and unrestricted. However, organizations are by definition organized. Labor is divided. Positions are formally differentiated both horizontally (by technology, workflow, task design) and vertically (by administrative hierarchy), and means for coordinating among differentiated positions are specified. Similarity is a relational concept and organizational coordination requirements may provide opportunities or restrictions on the extent to which a person is similar or dissimilar to others.

Balance

Early studies (DeSoto, 1960) showed that transitive, reciprocal relationships were easier to learn, an indication of how people organize relationships in their minds and an apparent preference for balance. More recently, Krackhardt & Kilduff (1999) found similar perceptual notions of balance in four organization based on distance from ego. Indeed, cognitive balance (Heider, 1958) is often at the heart of network explanations (see Kilduff & Tsai, 2003, for a more complete exploration). A friend of a friend is my friend; a friend of an enemy is my enemy. Granovetter's theory of weak ties assumes a relationship between alters who are both strongly tied to ego. Structurally, balance is seen as transitivity and efforts have been made to extend the triadic notion of balance to larger networks (Hummon & Doreian, 2003). However, we know that balance is not the sole mechanism for explaining network structure. In a perfectly balanced world, everyone would be part of one giant positive cluster, or two opposing clusters linked by negative ties. The adage "two's company, three's a crowd," also suggests that strong ties to alters do not guarantee that the alters will become friends themselves; rather, they may become rivals for ego's time and attention.

Human and Social Capital

As Lin's (2000) theory of social resources suggests, actors who possess more human capital (skills, abilities, resources, expertise) are going to be attractive partners to those with less human capital. Indeed, centrality in the advice network may provide a good proxy for expertise. However, affect plays an important role. Casciaro and Lobo (2008) found that when faced with the choice of "competent jerk" or a "lovable fool" as a work partner, people were more likely to choose positive affect over ability. Of course, relationships with persons with more human capital (e.g., status) are tempered by the high status person's possible reluctance to form a relationship with lower status people. However, in general, it's probably accurate to say that human capital creates social capital. In addition to human capital, those who possess more social capital may be more attractive than those who possess less. For example, forming a relationship with a person with many connections creates opportunities for indirect flows of information and other resources. While Coleman (1990) famously noted that social capital creates human capital, I note that human capital can create social capital and that social capital can create even more social capital.

Personality

Due to the structural aversion to individual attributes, until recently few studies had investigated the effects of personality on network patterns. Mehra, Kilduff and Brass (2001) found that high self-monitors were more likely to occupy structural holes in the network (connect to alters who were not themselves connected), and Oh and Kilduff (2008) reinforced these findings in a Korean sample. Self-monitoring refers to an individual's inherent tendency to monitor social cues and present the image suggested by

the audience. Using a battery of personality traits, Kalish and Robins (2006) found that individualism, high locus of control, and neuroticism were related to structural holes and . Klein, Lim, Saltz, and Mayer (2004) found a variety of personality factors related to in-degree centrality in advice, friendship, and adversarial networks. Yet, the results indicated relatively few correlates given the large number of possibilities in these studies and little variance explained. While many other network measures and personality traits might be correlated, the results suggest that strong theoretical rationale should precede empiricism.

Culture

Organizational and national culture also may be reflected in social network patterns. For example, French employees prefer weak links at work, whereas Japanese workers tend to form strong, multiplex ties (Monge & Eisenberg, 1987). Lincoln, Hanada, and Olson (1981) found that vertical differentiation was positively related to personal ties and work satisfaction for Japanese and Japanese Americans. Horizontal differentiation had negative effects on these workers. In addition, Xiao and Tsui (2007) found that bridging structural holes could be likened to standing in two boats in Chinese cooperative high-tech firms. More research is needed to fully understand how culture may affect social networks. In particular, research suggests that cooperative versus competitive cultures may be an important moderator of network effects.

Clusters and Bridges

Proximity, homophily, and balance predict that the world will be organized into clusters of close friends with similar demographics and values. Indeed, it is nice to be surrounded by people with the same values whom you can trust and rely upon for social

support. We add to this the tendency for friends to reinforce each other and become even more similar. As Feld (1981) notes, activities are often organized around "social foci" - actors with similar demographics, attitudes, and behaviors will meet in similar settings, interact with each other, and enhance that similarity. In-group/out-group biases foster tightly knit cliques. Yet, it is the bridges – people who connect different clusters - that make it a “small world.” Figure 2 represents the clusters and bridges thought to portray the way the world’s relationships are organized.

Whether these clusters represent the volunteers in Nebraska and lawyers in Boston, different departments in an organization, different ethnic groups, or, as is the case in this diagram from Rob Cross, an organization’s R&D departments in different countries, it is the bridges that make it possible for information or resources to flow from one cluster to another. As Travers and Milgram (1969) noted, letters that circulated among friends within the same cluster did not reach the lawyer in Boston. It was only when the letter was sent to a bridge that allowed it to reach it’s destination.

With the strong preferences for homophily and balance, what then motivates a person to connect with a different cluster? As Granovetter (1973) and Burt (1992) argue, there are advantages to connecting to those who are not themselves connected. Information circulates within a cluster and soon becomes redundant. Connecting to diverse clusters provides novel information and different perspectives that can lead to creativity and innovation (as well as finding a better job).

A variety of factors can affect social networks. Obviously the influences are complex and the effects cross levels of analysis. Additional influences remain to be explored. In addition, few studies have examined more than one influence. Multivariate

studies encompassing multiple theories and multiple levels of analysis are needed to begin to understand the complex interactions involved among the factors (Monge & Contractor, 2003).

SOCIAL NETWORKS: OUTCOMES

Returning to structuration theory, established patterns of interaction become institutionalized and take on the quality of socially shared, structural facts. Thus, network patterns emerge and become routinized and act as both constraints on, and facilitators of behavior. I now turn to the consequences of these networks, noting that the antecedents are only of interest if the networks affect important outcomes. I focus on traditional I/O topics and outcomes. Network research has followed two classes of outcomes: how people are the same (e.g., /contagion/diffusion studies) and how people are different (e.g., performance studies) based on their networks. I begin with attitude similarity.

Attitude Similarity: Contagion

Just as I noted the propensity for similar actors to interact, theory and research have also noted that those who interact become more similar (sometimes referred to as induced homophily). Ash's (1951) classic experiments on conformity demonstrate how individuals can be influenced by others. Erickson (1988) provides the theory and research concerning the "relational basis of attitudes." She argues that people are not born with their attitudes, nor do they develop them in isolation. Attitude formation and change occur primarily through social interaction. As people attempt to make sense of reality, they compare their own perceptions with those of others, in particular, similar others. Differences in attitudes of dissimilar others have little effect: disagreements can be attributed to the dissimilarity, and may even be used to reinforce one's own attitudes.

Attitude similarity has received much research attention under the general heading of “contagion.” Much writing has focused on the role of social networks in adoption and diffusion of innovations (cf. Burt, 1982; Rogers, 1971). These studies generally show that cosmopolitans (i.e., actors with external ties which cross social boundaries) are more likely to introduce innovations than are locals (Rogers, 1971). Likewise, central actors, sometimes identified as “opinion leaders” are unlikely to be early adopters of innovations when the innovation is not consistent with the established norms of the group (Rogers, 1971). The network studies focus on the spread of diseases as well as new ideas.

The classic study of the diffusion of tetracycline among physicians (Coleman, Katz & Manzel, 1957) showed the influence of networks on the prescriptions written for the new drug. However, re-analysis of the original data indicated that adoption was more a matter of occupying similar positions in the network (structural equivalence) than direct interaction. According to Burt (1987), actors cognitively compare their own attitudes and behaviors with those of others occupying similar roles, rather than being influenced by direct communications from others in dissimilar roles. Likewise, Galaskiewicz and Burt (1991) found similar evaluations of nonprofit organizations among structurally equivalent contributions officers, and structural equivalence explained these contagion effects better than the direct contact “cohesion” approach. Walker (1985) found that structurally equivalent individuals had similar cognitive judgments of means-ends relationships regarding product success.

However, supporting a direct connection, cohesion approach, Davis (1991) showed how the “poison pill” diffused through the network of inter-corporate ties. Likewise, Rice and Aydin (1991) found that attitudes about new technology were similar

to those with whom employees communicated frequently and immediate supervisors. However, estimates of others' attitudes were not correlated with others' actual (reported) attitudes. In another study, Rentsch (1990) found that members of an accounting firm who interacted with each other had similar interpretations of organizational events, and that these meanings differed qualitatively across different interaction groups. Krackhardt and Kilduff (1990) found that friends had similar perceptions of others in the organization, even when controlling for demographic and positional similarities. In a longitudinal study following a technological change, Burkhardt (1994) found attitude similarity among both structurally equivalent actors, and those with direct links. While the debate about structural equivalence vs. direct interaction generated several studies, research interest decreased as it seems both have an effect. In addition, the Coleman, Katz, and Manzel data (1957) that generated the original debate has been re-analyzed several times with each reanalysis refuting the previous one (see Kilduff & Oh, 2006, for an in-depth history and summary of results). Recent similarity studies have been more concerned with the topics of leadership (Pastor, Meindel & Mayo, 2002), perceptions of justice (Umphrees, Labianca, Brass, Kass, & Scholten, 2003) and affect (Totterdell, Wall, Holman, Diamond, & Epitropaki, 2004) than with the previous structural equivalence/cohesion debate.

Job Satisfaction

Despite attention to job satisfaction in the small-group laboratory network studies of the 1950s (see Shaw, 1964, for review), there have been few social network studies addressing job satisfaction in organizations. The early laboratory studies found that central actors were more satisfied than peripheral actors in these small (typically 5-

person) groups. Using crude network measures, Roberts and O'Reilly (1979) found that relative isolates (zero or one link) in the communication network were less satisfied than participants (two or more links). However, Brass (1981) found no relationship between centrality (closeness) in the workflow of workgroups or departments and employee satisfaction. Centrality within the entire organization's workflow was negatively related to satisfaction in this sample of nonsupervisory employees. Brass (1981) suggested that this latter finding may be due to the routine jobs associated with the core technology of the organization. He found that job characteristics mediated the relationship between workflow network measures and job satisfaction. Similarly, Ibarra and Andrews (1993) found that centrality in advice and friendship networks was related to perceptions of autonomy.

Although more research is needed, these limited results suggest that there may be a optimum degree of centrality in social network that is neither too little nor too great as regards satisfaction. Isolation is probably negatively related to satisfaction, while a high degree of centrality may lead to conflicting expectations, communication overload, and stress. In addition, interaction is not always positive. Since Durkheim (1897) argued that social integration promotes mental health, there has been a long history of equating social interaction with social support (Wellman. 1992). When possible, we tend to avoid interaction with people we dislike, thereby producing a positive correlation between interaction and friendship. However, work requirements place constraints on the voluntary nature of social interaction in organizations. The possibility that such required interaction may involve negative outcomes suggests the need for further research on the negative side of social interaction (Labianca & Brass, 2006).

Affect

Focusing on affect rather than job satisfaction, Totterdale, Wall, Holman, Diamond, and Epitropaki (2004) found that membership in a densely connected group was negatively related to negative affective states, and reductions in network density (due to a merger) were related to negative changes in affect. While interest in job satisfaction has waned, research on affect in organizations has dramatically increased (Barsade, Brief & Spataro, 2003; George & Brief, 1996). Of particular interest to network researchers is emotional contagion: the transfer and diffusion of moods and emotions within workgroups to the point of suggesting constructs such as group emotion (Barsade, 2002).

Power

A structural network perspective on power and influence has been the topic of much research. The finding that central network positions are associated with power has been reported in small, laboratory workgroups (Shaw, 1964) and interpersonal networks in organizations (Brass, 1984, 1985a; Brass & Burkhardt, 1993; Burkhardt & Brass, 1990; Fombrun, 1983; Krackhardt, 1990; Sparrowe & Liden, 2005). Theoretically, actors in central network positions have greater access to, and potential control over relevant resources, such as information. Actors who are able to control relevant resources, and thereby increase others' dependence on them, acquire power. In addition to increasing others' dependence on them, actors must also decrease their dependence on others. They must have access to relevant resources that is not controlled or mediated by others. Thus, two measures of centrality, closeness (representing access), and betweenness (representing control) correspond to resource dependence notions (Brass, 1984). Both measures have been shown to contribute to the variance in reputational measures of

power, and promotions in organizations (Brass, 1984, 1985a). In addition, simple degree centrality measures of the size of one's ego network (symmetric and asymmetric) have been associated with power (Brass & Burkhardt, 1992, 1993; Burkhardt & Brass, 1990).

Studying nonsupervisory employees, Brass (1984) found that links beyond the workgroup and workflow requirements (prescribed vertical and horizontal coordination) were related to influence. In particular, closeness to the dominant coalition in the organization was strongly related to power and promotions. The dominant coalition was identified by a clique analysis of the interaction patterns of the top executives in the company. Brass (1985a) also found that men were more closely linked to the dominant coalition (composed of four men) and were perceived as more influential than women. Assuming that power positions in most organizations are dominated by men, women may be forced to forgo any preference for homophily in order to build connections with the dominant coalition. Thus, the organizational context places constraints on preferences for homophily, especially for women and minorities (Ibarra, 1993). Women who were part of integrated formal workgroups (at least two men and two women) and who were linked (closeness centrality) to the men's network (only male employees considered) were perceived as more powerful than women who were not. Men who were closely linked to the women's network (only women employees considered) were also perceived as more influential than men who were not.

In integrating the structural perspective with the behavioral perspective, Brass and Burkhardt (1993) found that network position was related to behavioral tactics used, that both network position and behavioral tactics were independently related to perceptions of power, and that each (structure and behavior) mediated the relationship between the other

and power. In suggesting that network position represented potential power (i.e., access to resources), and that behavioral tactics represented the strategic use of resources, they concluded that behavioral tactics increased in importance as network position decreased in strength. Consistent with structuration theory, their results also supported the argument that behavioral tactics are used to secure privileged positions in the network.

Sparrowe and Liden (2005) related betweenness centrality in the advice network to power and also found a three way interaction between leader-member exchange relationships (LMX), supervisor centrality, and overlap between supervisor and subordinate network. Subordinates benefited from trusting LMX relationships with central supervisors who shared their network connections (sponsorship). When leaders were low in centrality, sharing ties in their trust network was detrimental.

Adopting a cognitive approach, Krackhardt (1990) found that the accuracy of individual cognitive maps of the social network in an organization was related to perceptions of influence. Power was related to the degree to which an individual's perception of the interaction network matched the "actual" social network. In a case analysis, Krackhardt (1992) also demonstrated how a lack of knowledge of the social networks in a firm prevented a union from successfully organizing employees.

The relation between networks and coalitions in organizations also has been the focus of several authors (Bacharach & Lawler, 1980; Murnighan & Brass, 1991; Stevenson, Pierce, & Porter, 1985; Thurman, 1979). Murnighan and Brass demonstrated how coalitions are formed one actor at a time and require the founder to have an extensive ego network of weak ties. Thurman (1979) described how leveling counter-coalitions are formed through existing social network ties.

Recruitment and Selection

Recruitment and selection rest on the simple assumption that both parties (i.e., the individual and the organization) must know of each other. In the classic example of the strength of weak ties, people were able to find jobs more effectively through weak ties (acquaintances) than strong ties or formal listings (Granovetter, 1982). Granovetter argued that an actor's set of weak ties will form a low density, high diversity network, one rich in nonredundant information. Later findings (Lin, Ensel, & Vaughn, 1981; Wegener, 1991) modified and emphasized the notion. They found that weak ties used in finding jobs were associated with higher occupational achievement when the weak ties connected the job seekers to those of higher occupational status. Thus, the effectiveness of weak ties rests in the diversity and nonredundancy of the information they provide.

Focusing on the employer side of the labor market, Fernandez and colleagues (Fernandez, Castilla & Moore, 2000; Fernandez & Weinberg, 1997) investigated the use of employee referral networks in recruitment and selection of bank employees. Organizations often provide monetary bonuses to employees who provide referrals who are eventually hired by the company and who remain for a specified period of time. Using employee networks for recruitment and selection is thought to provide a richer pool of applicants, a better match between referred applicants and job requirements, and social enrichment (referred applicants when hired have already established social connections to the referring employee). All three mechanisms suggest that referred hires are less likely to quit. Fernandez & Weinberg (1997) found that referred applicants had more appropriate resumes and timing, but these did not explain referrals' advantage in hiring. Fernandez, Castilla and Moore (2000) also found support for the richer pool

explanation, but did not find that referred applicants were better informed of job requirements (better match argument). There was some evidence of the social enrichment mechanism at work (interdependence of turnover between referrers and referrals). In a cost analysis, they found that the \$250 monetary bonus resulted in a return of \$416 in reduced recruiting costs. They also found evidence of homophily in hiring referrals, suggesting the danger of homosocial reproduction in organizations (Kanter, 1977). However, a diverse pool of existing employees can lead to continued diversity in the workforce. Consistent with the referral hiring advantage, Seidel, Polzer and Stewart (2000) found that hires with previous connections in the organization were able to negotiate higher salaries than those with no previous connections. Likewise, Williamson and Cable (2003) found that firms hired top management team members from sources with whom they shared network ties. They also noted social contagion effects among firms in their hiring practices. Similarly, in a qualitative study, Leung (2003) found that entrepreneurial firms tended to rely on strong, direct ties in recruitment and selection of employees.

Pfeffer (1989) has noted that selection is not entirely the result of abilities and competences. Credentials and hiring standards are often the result of political contests within organizations. Those in power seek to perpetuate their power and further build coalitions and alliances by setting criteria and selecting those applicants most like themselves. Thus, as in the case of recruiting via the use of networks, selection may also largely depend on network ties. This is particularly true when the qualified applicant pool is large, or when hiring standards are ambiguous. In such cases, similarity between applicant and recruiter may be an important basis of the selection choice. Because of the overlap between social networks and actor and attitude similarity, selection research

might fruitfully pursue the effects of patterns of social relationships on hiring decisions. For example, Halgin (2009) found effects for connections to high status others on hiring decision, even when controlling for previous performance.

Burt and Ronchi (1990) provided an analysis of hiring practices in an organization in which conflict had escalated to the point of shootings and bomb threats. They attempted to guide the senior executives past the attributions of personality and attributes to reach the underlying social network of the organization. They used the archival data provided in the application forms of current employees to trace the historical pattern of hiring and match it to the warring factions in the company. The social network data came from questions on the application forms of 1721 current employees asking them: (a) if they knew anyone (i.e., friends, acquaintances, or relatives) working for the firm, (b) how they learned about the job opening, and (c) names of references. Added to the network analyses were the addresses of employees. Analyses of the social connections show how a lower-level manager, since fired, had virtually taken control of the company years earlier by hiring family, friends, and friends of friends, almost exclusively from a particular geographical location (his community). The conflicts arose between those people obligated to the lower-level manager and others hired from a rival community. Studying the social network patterns also provided possible solutions for resolving the conflict by identifying as possible mediators those employees with links to both groups (Burt & Ronchi, 1990). The case analysis provides a rich example of the political perspective, homophily, and a social network analysis of selection.

Socialization

Following selection, the social networks of new employees may be a key to their socialization into the organization. Two related studies dealing with the socialization of new employees (Jablin & Krone, 1987; Sherman, Smith, & Mansfield, 1986) indicate that network involvement is a key process in assimilation of new employees. Eisenberg, Monge, and Miller (1984) found that network participation was related to organizational commitment for salaried employees. Similarly, Morrison (2002) found that network size, density, tie strength, and range were related to organizational knowledge, task mastery, and role clarity. Newcomers' friendship networks related to their social integration and organizational commitment. However, due to the cross-sectional nature of these studies, it is impossible to know whether integration into the network leads to commitment, or vice versa. Position in the network and socialization and commitment are likely to be reciprocally causal.

Training

Few studies address social networks or provide a structural perspective on training (Brass, 1995a). If training is viewed as acquiring new and innovative ideas and skills, once training is introduced or adopted, the diffusion of the training (or the spread of new ideas and skills) can be predicted by social network relationships. For example, Burkhardt and Brass (1990) investigated the introduction, training, and diffusion of a major technological change in an organization. The diffusion process closely followed the network patterns following the change, with structurally equivalent employees adopting at similar times.

In a similar study of the introduction of a new computer technology, Papa (1990) found that productivity following the change was positively related to interaction

frequency, network size, and network diversity (i.e., number of different departments and hierarchical levels contacted). Frequency, size, and diversity also predicted the speed at which the new technology was learned (time to reach 110% of past productivity). Papa argued that training programs can provide basic operating information, but that much of the learning about a new technology occurs after training as employees attempt to apply the training. Communicating with others to gather and understand information had a positive effect on productivity, even when controlling for past performance.

Training may also be viewed as an opportunity to build social connections among participants. Network connections made as cohorts proceed through intense training experiences (e.g., military training) or through life experiences in college can become deep and lasting (Brass, 1995a). Organizations may wish to use training to build connections across diverse, heterogeneous groups in anticipation of the future formation of cross-functional teams, or may encourage “staff swaps” to integrate distinct subcultures in organizations (Krackhardt & Hanson, 1993). However, structured interaction does not always lead to stable links and longitudinal research is needed to map network connections formed during training.

Career Development: Getting Ahead

Subsequent to Granovetter’s strength of weak ties, Burt’s 1992 book, “Structural Holes” was perhaps the most influential research in propelling studies of social networks. Burt (1992) argued that the size of one’s network is not as important as the pattern of relationships; in particular, the extent to which your contacts are not themselves connected (creating a “structural hole” in your network). Based on Simmel’s (1950) analysis of triads, Burt noted the advantages of the “tertius gaudens” (i.e., “the third who

benefits”). Not only does the “tertius” gain nonredundant information from the contacts (i.e., the strength of weak ties argument), but the tertius is in a position to control the information flow between the two (i.e., broker the relationship), or play the two off against each other. The tertius profits from the disunion of others. However, in order to play one off against the other, the two alters need to be somewhat redundant, offsetting any advantage gained from non-redundant information. In addition, the irony of the structural hole strategy is that connecting to any alter creates brokerage opportunities for the alter as well as for ego (Brass, 2009). Without entirely ignoring the strength of ties, Burt argued that a direct, structural measure of disconnection among alters was preferable to the weak tie proxy. Contrasted with Coleman’s (1990) and Putnam’s (1995) conceptualization of social capital as trust generated by closed networks, Burt’s focus on the social capital of structural holes led to a tremendous number of research studies.

Using the criterion of rate of previous early promotions, Burt (1992) found the presence of structural holes to be more effective for a sample of 284 managers in a large, high-technology firm, except in the case of women and newly hired managers. For women and newcomers, a strong tie pattern of connecting to well-connected sponsors worked best. Burt, Hogarth and Michaud (2000) replicated the benefits of structural holes for French managers using salary as the dependent variable. Often cited in support of Burt’s structural hole hypothesis, Podolny and Baron (1997) found that an upward change in grade shift during the previous year (mobility) was related to large, sparse networks. Unlike Burt (1992) who aggregated across five different networks, Podolny and Baron found that in one of the five networks (the “buy-in” network) dense connections were advantageous, providing what Podolny and Baron suggested was an

identity advantage of closed networks. They argue that the content of the network makes a difference. Because the network data in each of the above studies were not longitudinal, it is difficult to discern whether the networks were the result of promotions or the cause of promotions (although Podolny and Baron eliminated ties formed following promotions). However, previous studies by Brass (1984, 1985) support Burt's contention, finding that betweenness centrality (a whole network measure of structural holes within departments) led to promotions for both men and women three years following the network data collection. Supporting Lin's (1999) resource approach, Brass also found that connections to the dominant coalition (a highly connected group of top executives) were significantly related to promotions.

In a study of 1359 Dutch managers, Boxman, De Graaf, and Flap (1991) found that external work contacts and memberships related to income attainment and level of position (number of subordinates) for both men and women when controlling for human capital (education and experience). The return on human capital decreased as social capital increased. In a study combining different network approaches (structural, relational, resource, and attribute) and measuring flows, Seibert, Kraimer & Liden (2001) found that both weak ties and structural holes in career advice network were related to social resources which in turn was related to salary, promotions over career, and career satisfaction.

Individual Performance

As with promotions, Burt's (1992) structural hole theory has also been applied to individual performance in organizations. Supporting this approach, Mehra, Kilduff, & Brass (2001) found that betweenness centrality was related to supervisors' ratings of

performance. Likewise, Mizruchi and Stearns (2001) found that density (few structural holes) and hierarchy (dominated by one or a few persons) in approval networks negatively related to closing bank deals. Network size was positively related, and strength of tie was negative. Also supporting structural holes, Cross & Cummings (2004) found that ties to diverse others related to performance in knowledge intensive work. Finally, Burt (2007) reports relationships between structural holes and performance for three samples: supply chain managers (salary and performance evaluations), investment bankers (annual compensation), and financial analysts (election to the Institutional Investor All-American Research Team). Sparrowe, Liden, Wayne, and Kraimer (2001) found that in-degree centrality in the advice network was positively related to supervisor ratings of performance but they did not include measures of structural holes in their analysis. Different findings were reported in one study (Lazega, 2001) indicating that constraint (lack of structural holes) positively related to performance (billings) in a U.S. law firm. Lazega extensively describes the cooperative, sharing culture in the law firm, suggesting a cooperation/competition contingency. Supporting the notion of a cooperation contingency, Xiao and Tsui, (2007) found that structural holes had a negative effect on salary and bonuses in high-commitment organizations in the collectivist culture of China. They liken the structural hole position to a Chinese cultural interpretation of “standing in two boats.” Noting the difference in being the object of directional relationships, rather than the source (Burt & Knez, 1995), Gargiulo, Ertug, and Galunic (2009) found that closed networks were beneficial (bonus) for information seekers, but not information providers. Although the data in the above studies are cross

sectional, and some evidence suggests a cooperation/competition contingency, there seems to be solid support for the structural hole – performance relationship.

In a cognitive approach to performance, Kilduff and Krackhardt (1994) found that being perceived as having a powerful friend in the organization related to reputation for good performance, although actually having a powerful friend was not related to reputation. While being closely linked to a powerful other may result in “basking in the reflected glory,” it may also result in being perceived as “second fiddle.” In the latter case, one’s own talents are diminished in the presence of a powerful other (i.e., one is perceived as “riding the coattails” or “second fiddle”). The difference in perceptions, and the difference in career advantage, may be the result of the stage of one’s career, boundaries to entry, and/or the type of organization. Early in one’s career, strong connections to a mentor are perceived as an indication of potential success. However, the reliance on indirect links creates a dependency on the highly connected other (mentor) to mediate the flow of resources; thus, a strong tie to the mentor (or high LMX with one’s supervisor) is likely necessary (Sparrowe & Liden, 2005).

Group Performance

A variety of studies have investigated the effects of interpersonal network patterns on group performance. Uzzi (1997) described how embedded relationships characterized by trust, fine-grain information, and joint problem solving can have both positive and negative economic outcomes for small firms in the garment industry. Firms can become over-embedded and miss economic opportunities presented by “arms-length” transactions. Hansen (1999) found that weak inter-unit ties speed up group project completion times when needed information is simple, but slows them down when

knowledge to be transferred is complex. He concludes that weak ties help search activities; strong ties help knowledge transfer. Of course, employees must know who knows what in the organization (Borgatti & Cross, 2003). Tsai (2001) noted that in-degree centrality in knowledge transfer network (among units) interacted with absorptive capacity to predict business unit innovation and performance.

Much of the work on interpersonal networks and group performance has been done by Reagans, Zuckerman, & McEvily (e.g., 2004) who conclude that internal density and external range in knowledge sharing network related to group performance (as measured by project duration). Similarly, Oh, Chung, & Labianca (2004) found that internal density (inverted U relationship) and number of bridging relationships to external groups in an informal socializing network related to group performance (as rated by executives). A meta-analysis by Balkundi & Harrison, (2005) showed that density within teams, leader centrality in team, and team centrality in intergroup network related to various performance measures. These studies provide an easy solution to the debate about structural holes and cohesion. Teams benefit from internal cohesion and external links to other groups that are not themselves connected.

Leadership

Despite early laboratory studies showing that central actors in centralized group structures were overwhelmingly chosen as leaders (Leavitt, 1951; see Shaw, 1964 for a review), there have been few empirical studies of networks and leadership (see Sparrowe & Liden, 1997; Brass & Krackhardt, 1999; Balkundi & Kilduff, 2005 for theoretical articles). An exception is Mehra et al.(2005) who found that leaders' centrality in external and internal friendship networks was related to objective measures of group

performance and to their personal reputations for leadership among different organizational constituencies.

Job Design

Although traditional research on job design (e.g., Hackman & Oldham, 1976) waned in the 1990s, an early study by Brass (1981) found that job characteristics (e.g., task variety and autonomy) mediated relationships between workflow centrality in the workgroup and employee satisfaction and performance. Centrality within the entire organization's workflow network (rather than the smaller workgroups) was negatively related to job characteristics (Brass, 1981). Brass argued that the latter jobs were routinized, mechanistic jobs in the technical core, buffered by more complex, uncertain jobs on the boundary of the organization. In a later study, Brass (1985b) used network techniques to identify pooled, sequential, and reciprocal interdependencies within workgroups. He found that performance varied according to combinations of technological uncertainty, job characteristics, and interaction patterns. The results suggest that the relationship between interpersonal interaction and performance is a complex one dependent upon tasks and workflow, a possible contingency factor noted by Burt (2000).

This conclusion is consistent with small group laboratory network studies of the early 1950's (see Shaw, 1964 for a review). Although these early laboratory studies were highly controlled and simplistic, some consistent findings emerged. Centralized communication networks (e.g., Figure 1a) resulted in more efficient performance when tasks were simple and routine. Decentralized networks (e.g., Figure 1b) were better at performing complex, uncertain tasks. That is, performance is better when the communication structure matches the information processing requirements of the task.

For a summary of the recent resurgence in job design from a social perspective, see Grant and Parker (2009).

Turnover

In a study of fast-food restaurants, Krackhardt and Porter (1986) found that turnover did not occur randomly, but in structurally equivalent clusters in the perceived interpersonal communication network. That is, turnover was a function of the social network context. In a related study, Krackhardt and Porter (1985) looked at the effects of turnover on the attitudes of those who remained in the organization. In this longitudinal study, the closer the employee was to those who left, the more satisfied and committed the remaining employee became. The authors argued that remaining employees cognitively justified their decision to stay by increasing their satisfaction and commitment. Although Krackhardt used cognitive network data, he did not focus on the extent to which turnover in the network provides a signal (prism effect) that activates or justifies additional turnover or whether a threshold effect leads to massive exits detrimental to the organizations survival.

From a different perspective, Shaw, Duffy, Johnson and Lockhart (2005) investigated the effects of turnover of key network actors (above and beyond turnover rate and individual performance) on the organizational performance of 38 restaurants. They found support for a curvilinear relationship between the loss of employees who occupied structural holes in the network and organizational performance.

Justice

According to equity theory (Adams, 1965), employees compare their perceived input outcome ratios with their perceptions of others' input/outcome ratios. The problem of testing equity predictions outside the laboratory has been the large number of possible "others" that might be considered for possible comparison. Noting this problem, Shah (1998) found that people rely on structurally equivalent others in making task-related comparisons and friends when making social comparisons.

Although justice research has always been relational, few studies have progressed past the dyadic comparison. Degoey (2000: 51) notes that the "often ambiguous and emotionally charged nature of justice-related events" compels actors to make sense of these events through social interaction. He provides an extensive review and hypotheses concerning "storytelling" and the social construction and maintenance of shared justice perceptions over time. Building on this work, Shapiro, Brass and Labianca (2008) theorize about how network patterns might affect the diffusion and durability of justice perceptions.

Negotiations

Few topics have generated as much research over the past 40 years as negotiations (see Bazerman, Curhan, Moore & Valley, 2000, for a review). Despite the many empirical studies, social relationships have been relatively neglected (Valley, Neale & Mannix, 1995), and even fewer studies have gone beyond the negotiating dyad (Valley, White, & Iacobucci, 1992) to consider triadic relations or the entire network. Yet, it is likely that the social networks of negotiators will affect both the process and outcomes of negotiations. To the extent that negotiations involve the exercise of power, the network findings regarding centrality should provide some clues as to asymmetric advantages.

Structural holes may provide useful, non-redundant information or tap into transaction alternatives that can be played off against each other, while overlaps in negotiators' networks may provide the closure necessary for trust, reciprocity, and mutually beneficial outcomes. While Granovetter (1985) and Uzzi (1997) have demonstrated how economic transactions are embedded in social relations, McGinn and Keros (2002) have shown how such social ties ease coordination within a negotiation and allow for an improvised shared logic of exchange that facilitates negotiation. Thus, the structural results of network analysis may add predictive power to negotiation research while the more cognitive and behavioral insights from negotiation research may provide the understanding of the process mechanisms often missing from network analysis.

Conflict

In a study of twenty organizations, Nelson (1989) found that low-conflict organizations were characterized by a high number of strong ties between members of different groups. Analyzing the overall pattern of ties, Nelson argued that the interaction networks were significantly different for high and low conflict organizations. However, when including negative ties, Labianca, Brass and Gray (1998) found that friendship ties across groups was not related to perceptions of intergroup conflict, but negative relationships (measured as "prefer to avoid" a person) were related to higher perceived conflict. Indirect relationships (friends who reported negative relationships across groups) also related to perceptions of intergroup conflict.

Citizenship Behavior

Despite a tremendous amount of research on organizational citizenship behavior (e.g., Bateman & Organ, 1983; Podsakoff, MacKenzie, Paine & Bachrach, 2000) very few studies of this topic have adopted a social network perspective. Many of the studies focus on a perceived equity exchange between the employee and the organization. Settoon and Mossholder (2002) found that in-degree centrality related to supervisors' ratings of person- and task-focused interpersonal citizenship behavior. Rather than focus on the employee/organization exchange, Bowler and Brass (2006) investigated affective exchange between employees. Interpersonal citizenship behavior (as reported by recipients of the behavior) was significantly related to friendship even when controlling for job satisfaction, commitment, procedural justice, hierarchical level, demographic similarity, and job similarity. People also performed helping behavior for more powerful others and friends of more powerful others. Reversing the causality, Bolino, Turnley, & Bloodgood (2002) argue that organizational citizenship behavior can result in the creation of social capital within an organization. They provide a theoretical model of how Van Dyne, Graham, and Dienesch's (1994) five OCB dimensions can foster ties that can be appropriated for other uses, can foster relationships characterized by liking, trust, and identification, and promote shared narratives and language.

Creativity/Innovation

Fueled by the notion that creativity in organizations often involves the synthesis or recombination of different ideas or perspectives, researchers have begun to look beyond individual cognitive processes for social sources of diverse knowledge (Amabile, 1996), such as an individual's network (Perry-Smith & Shalley, 2003). Following Granovetter (1973), Brass (1995) proposed that weak ties should provide non-redundant

information and thereby increase creativity. Burt (2004) found that ideas submitted by managers with structural holes were judged by top executives to be more creative than managers with few structural holes. Perry-Smith (2006) found effects for weak ties, but not structural holes (using the whole network measure of betweenness centrality) on supervisor ratings of employee creativity. Using a similar measure of employee creativity in a Chinese sample, Zhou, Shin, Brass, Choi and Zheng (2009) found a curvilinear relationship between weak ties and creativity, but no relationship for structural holes. They argue that weak ties not only captures non-redundant information between alters but also captures homophily effects between ego and alters. This is also one of the few studies to investigate an interaction between individual attributes and networks. They found an interaction between conformity values and weak ties. People with low conformity values were able to take advantage of the opportunities presented by weak ties.

Viewing innovation as the implementation of creative ideas, Obstfeld (2005) focused on a *tertius iugens* orientation: the tendency to bring people together by closing structural holes. Ego network density (few structural holes) combined across several networks related to involvement in innovation. Density positively related to structural holes suggesting that closing holes may lead to reciprocation. Obstfeld's (2005) findings were consistent with an earlier study (Ibarra, 1993) that found centrality (asymmetric Bonacich measure) across five networks related to involvement in technical and administrative innovations. Obstfeld argued that structural holes may lead to creative ideas, but innovation requires the cooperation of closed networks. Focusing on utility

patents, Fleeming, Mingo, and Chen (2007) found that collaborative brokerage (structural holes) helped generate patents but hampered their diffusion and use by others.

Unethical Behavior

In his critique of economics, Granovetter (1985) noted how social relationships and structure affect trust and malfeasance. Economic transactions are embedded in social relationships and actors do not always pursue self interests to the detriment of social relationships. Brass, Butterfield, and Skaggs (1998) build on these ideas within the context of ethics research. They argue that the constraints of various types of relationships (strength, status, multiplexity, asymmetry) and the network structure of relationships (density, cliques, structural holes, centrality) on unethical behavior will increase as the constraints of characteristics of individuals, organizations, and issues decrease, and vice versa. However, such predictions are extremely difficult to test in natural settings. One exceptional paper, Baker and Faulkner (1993) focused on price fixing conspiracies (illegal networks) in the heavy electrical equipment industry. In this network study, convictions, sentences, and fines related to personal centrality, network structure (decentralized) and management level (middle).

CONCLUSION: Challenges and Opportunities

Overall, I have attempted to demonstrate how a social network perspective might contribute to our understanding of industrial/organizational psychology. In the process, I have tried to note challenges and opportunities for future research. While the structural perspective has provided a useful niche for social network research, measuring the pattern of nodes and ties challenges the researcher to provide explanations of why these patterns of social relations lead to organizational outcomes. While the network provides

a map of the highways, seldom is the traffic measured (Brass, 1984; Stevenson & Gilly, 1991). For example, various explanations are provided for the benefits of structural holes (Burt, 1992). Ego may play one alter off against another, ego may acquire non-redundant information or other helpful resources, ego may recognize a synergistic opportunity and act on it herself, or ego may refer one alter to the other and benefit from future reciprocation. Or, ego may simply be mediating a conflict between the two alters. Similarly, network closure is assumed to provide trust and norms of reciprocation but seldom are these explanatory mechanisms verified. Future network research will need to measure the processes and mechanisms to get a fuller understanding of the value of particular structural patterns.

In establishing the predictive value of a structural perspective, network researchers have emphasized the importance of relationships to the detriment of individual agency. Although few management network scholars deny the importance of individual agency, few efforts have been made to tap the hallmark of industrial/organizational psychology: the ability and motivation of actors. While network researchers have begun to include personality variables, it was previously assumed that, other things being equal, actors would be capable and motivated to take advantage of network opportunities (or equally constrained by existing structures). Researchers will not only need to account for ability and motivation, but also identify strong structures that overwhelm individual agency (i.e. Figure 1a) and weak structures that maximize individual differences (i.e., Figure 1b). It is likely that individual attributes will interact with network structure to affect outcomes (e.g., Zhou et al., 2009),

The next logical growth in network research is the evolution of networks; how they change over time. Although there are few longitudinal studies of network change at the individual level (e.g., Barley, 1990; Burkhardt & Brass, 1990), inter-organizational scholars are now leading the boom via the use of archival, longitudinal, alliance data (e.g., Gulati, 2007). In addition, network scholars have actively devised computer simulations of network change (e.g., Buskens & van de Rijt, 2008; Gilbert & Abbott, 2005). Several questions beg for research. How are ties maintained and what causes them to decay or be severed (Burt, 2002; Shah, 2000)? What are the effects of past ties, and can dormant, inactive, past ties be reactivated? Does the formation of new ties affect existing ties, and vice versa? Can external agents (i.e., managers) affect the network formation and change of others? How do endogenous factors contribute to network change? For example, it is likely that network centrality leads to success and that success in turn leads to greater network centrality. Many opportunities exist for research on the dynamics of networks.

It has become popular to apply network thinking to various established lines of research, much as I have done in this chapter. Equally profitable would a reverse process of applying findings from traditional research to social network analysis. What can social network researchers learn from industrial/organizational psychology? It is a small world of industrial/organizational psychologists and social network researchers if bridges exist across these disciplinary clusters. Hopefully, this chapter will foster such bridges by energizing collaborative research.

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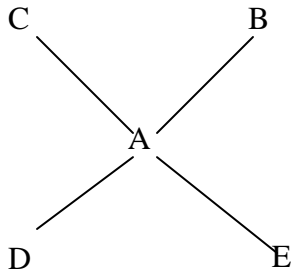
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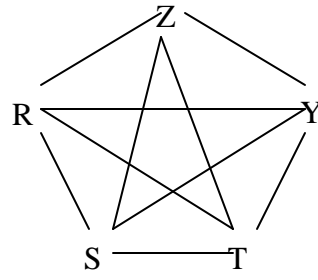


Figure 1.

Table 1. Typical Structural Social Network Measures Assigned to Individual Actors

<i>Measure</i>	<i>Definition</i>
Degree	Number of direct links with other actors
In-degree	Number of directional links to the actor from other actors (in-coming links)
Out-degree	Number of directional links from the actor to other actors (out-going links)
Range (Diversity)	Number of links to different others (others are defined as different to the extent that they are not themselves linked to each other, or represent different groups or statuses)
Closeness	Extent to which an actor is close to, or can easily reach all the other actors in the network. Usually measured by averaging the path distances (direct and indirect links) to all others. A direct link is counted as 1, indirect links receive proportionately less weight.
Betweenness	Extent to which an actor mediates, or falls between any other two actors on the shortest path between those two actors. Usually averaged across all possible pairs in the network.
Centrality	Extent to which an actor is central to a network. Various measures (including degree, closeness, and betweenness) have been used as indicators of centrality. Some measures of centrality (eigenvector, Bonacich) weight an actor's links to others by the centrality of those others.
Prestige	Based on asymmetric relationships, prestigious actors are the object rather than the source of relations. Measures similar to centrality are calculated by accounting for the direction of the relationship (i.e., in-degree).
Structural Holes	Extent to which an actor is connected to alters who are not themselves connected. Various measures include ego-network density and constraint as well as betweenness centrality.
Ego-network density	Number of direct ties among other actors to whom ego is directly connected divided by the number of possible connections among these alters. Often used as a measure of structural holes when controlling for the size of ego's network.
Constraint	Extent to which an actor (ego) is invested in alters who are themselves invested in ego's other alters. Burt's (1992: 55) measure of structural holes; constraint is the inverse of structural holes.
Liaison	An actor who has links to two or more groups that would otherwise not be linked, but is not a member of either group.
Bridge	An actor who is a member of two or more groups.

Table 2. Typical Structural Social Network Measures Used to Describe Entire Networks

<i>Measure</i>	<i>Definition</i>
• Size	Number of actors in the network
• Inclusiveness	Total number of actors in a network minus the number of isolated actors (not connected to any other actors). Also measured as the ratio of connected actors to the total number of actors.
• Component	Largest connected subset of network nodes and links. All nodes in the component are connected (either direct or indirect links) and no nodes have links to nodes outside the component. Number of components or size of largest component are measured.
• Connectivity (Reachability)	Minimum number of actors or ties that must be removed to disconnect the network. Reachability is 1 if two actors can reach each other, otherwise 0. Average reachability equals connectedness.
• Connectedness/fragmentation	Ratio of pairs of nodes that are mutually reachable to total number of pairs of nodes
• Density	Ratio of the number of actual links to the number of possible links in the network.
• Centralization	Difference between the centrality scores of the most central actor and those of other actors in a network is calculated, and used to form ratio of the actual sum of the differences to the maximum sum of the differences
• Core-peripheriness	Degree to which network is structured such that core members connect to everyone while periphery members connect only to core members and not other members of the periphery.
• Transitivity	Three actors(A, B, C) are transitive if whenever A is linked to B and B is linked to C, then C is linked to A. Transitivity is the number of transitive triples divided by the number of potential transitive triples (number of paths of length 2). Also known as the weighted clustering coefficient.
Small-worldness	Extent to which a network structure is both clumpy (actors are clustered into small clumps) yet having a short average distance between actors.

Table 3. Typical Relational Social Network Measures of Ties

<i>Measure</i>	<i>Definition</i>	<i>Example</i>
indirect links	Path between two actors is mediated by one or more others	A is linked to B, B is linked to C, thus A is indirectly linked to C through B
frequency	How many times, or how often the link occurs	A talks to B 10 times per week
duration (stability)	Existence of link over time	A has been friends with B for 5 years
multiplexity	Extent to which two actors are linked together by more than one relationship	A and B are friends, they seek out each other for advice, and work together
strength	Amount of time, emotional intensity, intimacy, or reciprocal services (frequency or multiplexity sometimes used as measures of strength of tie)	A and B are close friends, or spend much time together
direction	Extent to which link is from one actor to another	Work flows from A to B, but not from B to A
symmetry (reciprocity)	Extent to which relationship is bi-directional	A asks for B for advice, and B asks A for advice

