

SOCIAL NETWORKS: THE STRUCTURE OF RELATIONSHIPS

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To CITE: Brass, D.J. & Halgin, D.S. 2012. Social networks: the structure of relationships. In L.T. Eby & T.D. Allen (Eds.), *Personal relationships: The effect on employee attitudes, behaviors, and well-being*, 367 - 381. *SIOP Frontiers Research Series*, New York: Routledge.

We are 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.

While relationships are the basic building blocks of social network analysis, it is the focus on the pattern or structure of relationships that has provided social network researchers with a distinctive niche (Kilduff & Brass, 2010). The idea of a network implies more than one link and the added value of the network perspective is that it goes beyond the dyad and provides a way of considering the structural arrangement of many nodes. For example, while the dyadic relationships between managers and subordinates have long been the focus of leadership studies, Sparrowe and Liden (2005) focused on the network beyond the dyad and found a three way interaction between leader-member exchange relationships (LMX), supervisor centrality, and the overlap between supervisor and subordinate networks. Subordinates benefited from trusting LMX relationships with central supervisors who shared their network connections (sponsorship). When supervisors were low in centrality, sharing ties in their trust network was detrimental. The focus is on the relationships among the dyadic relationships (i.e., the network). The network approach can shed light on relevant managerial issues such as leadership, employee retention, and performance through an analysis of relationships such as collaborative practices linking members of a work department, trust bonds among employees and supervisors, exchanges between employees and customers, and many others (see Brass, 2011 and Brass, Galaskiewicz, Greve, & Tsai, 2004 for reviews of research findings). We organize our chapter to address basic definitions of network analysis, key research issues such as data organization, collection and analysis, and implications of research.

Social Network Data

We define a social network as a set of actors (individuals, groups, organizations) and the set of ties representing some relationship or absence of relationship between the actors.

Relationships include: (1) similarities (e.g., physical proximity, membership in the same group),

(2) social relations (e.g., kinship, friendship, knows about), (3) interactions (talks with, gives advice to), or (4) flows (information, resources) (Borgatti, Mehra, Brass & Labianca, 2009; Borgatti & Halgin, 2011). The pattern of ties in a network yields a particular structure, and actors occupy positions within this structure. 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, and popular notions such as “It’s a small world” and “six degrees of separation”. We refer to a focal actor in a network as “ego;” the other actors with whom ego has direct relationships are called “alters.” Social network data may be collected from informant perceptions (interviews or questionnaires), observations, archival records (e-mail, membership in groups), or a combination of these methods. At the interpersonal level, most organizational behavior researchers use questionnaires to obtain self-reports from actors. Respondents are asked to identify the alters with whom they have certain relations (e.g, talk with, trust, are friends with, etc.). Respondents can be provided with a *roster* of all names in the network of interest or asked to *list* the names of alters in response to name generators. The roster method will almost always result in larger reported networks and may be preferable when attempting to identify acquaintances in addition to closer, more frequent ties. However, it requires the researchers to identify all possible alters prior to data collection. The list method relies on people remembering all important alters and having the time and motivation to list them all. Although Bernard and colleagues (Bernard, Killworth, Kronenfeld, & Sailer, 1984) show that people are not very accurate in reporting specific interactions, reports of typical, recurrent interactions are reliable and valid (Freeman, Romney & Freeman, 1987).

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). In the ego network approach, ego is typically asked to list his alters and to indicate whether the alters are themselves connected. For example, the researcher might elicit the names of all people with whom ego has discussed personal matters during a certain time period. The researcher often collects attribute information about each of the alters (e.g., demographic, socioeconomic status, etc) and whether the alters know each other. Such data is limited by ego's ability to accurately describe the connections among 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 immediate alters. Ego network data can be analyzed using E-NET (Borgatti 2006) to investigate the composition and structure of each ego's network and how these factors are related to outcome variables such as career satisfaction or job search success.

Whole network data consists of the collection of all relationships between all actors within a specified network. This approach allows the researcher to calculate extended paths and additional structural measures, but care must be taken on the part of the researcher to accurately specify the network (important nodes and links must be included). This type of data is typically organized in a 1-mode (e.g., person-by-person) matrix, termed an adjacency matrix. The values of the cells within the matrix indicate the presence/strength of the relationship from the actor in the corresponding row to the actor in the corresponding column. Ties may be asymmetric (e.g., A gives advice to B but B does not give advice to A), directional (A sends information to B), binary (presence or absence) or valued (e.g., frequency or intensity). Computational programs such as UCINET (Borgatti, Everett & Freeman, 2002), SIENA (Snijders, Steglich, Schweinberger, & Huisman, 2005), and Pajek (Batagelj & Mrvar, 1998) specialize in the analysis of whole network data.

Analyzing Network Data

The network approach has gained a strong foothold across a variety of disciplines by virtue of its ability to go beyond the dyad in focusing on the structure of relationships (for in-depth reviews of organizational network research see Borgatti & Foster, 2001; Brass, 2011; Brass et al., 2004; Kilduff & Brass, 2010). Most 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. Consider the diagrams in Figure 1. Without reference to what the ties or actors represent, it is easy to hypothesize that the center actor (position A) in Figure 1a is the most powerful, and research confirms the centrality-power relationship (Brass, 1984, 1985, 1992).

Insert figure 1 about here.

We formed this hypothesis by simply noting the pattern or structure of the actors and ties. From a purely structural perspective, a tie is a tie, and actors are differentiated on the basis of their positions in the network (e.g., B, C, D, E are considered “structurally equivalent” because they have the same pattern of ties and therefore likely have similar outcomes). It is the *pattern* of relationships that provide the opportunities and constraints that affect outcomes. Network measures of centrality 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. For example, simply adding an additional actor to each of the alters (B, C, D, and E) in Figure 1a will affect the power of Actor A.

The diagrams in Figure 1 also illustrate the debate on social capital: benefits derived from relationships with others (see Adler & Kwon, 2002 for a cogent discussion). As differentiated from human capital (an individual's skills, ability, intelligence, personality, etc.) or financial capital (money), it comes in many different shapes and sizes but is defined by its function. The "structural hole" approach to social capital is exemplified by Burt's (1992) work on the benefits to ego via connecting to alters who are not themselves connected (creating a "structural hole" in ego's network). Actor A in Figure 1a has structural holes between each pair of the other alters. Burt (1992) noted the advantages of the "tertius gaudens" (i.e., "the third who benefits"). The tertius is in a position to control the information flow between the disconnected alters (i.e., broker the relationship), or play them off against each other. A less obvious advantage of structural holes is ego's access to non-redundant information. Alters who are connected share the same information and are often part of the same social circles. Alters who are not connected often represent different social circles and are sources of different, non-redundant information – information that may prove useful to finding jobs (Granovetter, 1973), work place performance (Mehra, Kilduff & Brass, 2001), promotions (Brass, 1984; Burt, 1992) and creativity (Burt, 2004). However, the two advantages appear to be a tradeoff: 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 disconnected alter creates brokerage opportunities for the alter as well as for ego (Brass, 2009). However, a considerable number of studies have indicated advantages to actors who occupy structural holes (Brass, 2011).

Alternatively, the "closure" perspective on social capital is exemplified by Coleman's (1990) often cited reference to social capital resulting from "closed" networks (a high number

of interconnections between members of a group; ego's alters are connected to each other as in Figure 1b). Closed networks allow for the development of shared norms, social support and a sense of identity (Halgin, 2009). Information circulates easily within closed networks and the potential damage to one's reputation discourages unethical behavior and, consequentially, fosters generalized trust among members of the network (Brass, Butterfield & Skaggs, 1998). Rather than "divide and conquer," third parties in closed networks have incentives to mediate conflicts and preserve the trust and social support of a tightly knit group. However, closed networks can be constraining and limit the non-redundant information obtained by forging ties with alters who are disconnected. Indeed, both the structural hole and closure perspectives are based on the underlying network proposition that densely connected networks constrain attitudes and behavior. From the closure perspective, constraint promotes trust, norms of reciprocity, monitoring and sanctioning of inappropriate behavior; from the structural hole perspective, constraint leads to redundant information and a lack of novel ideas.

Focus on Relationships

Strong ties, weak ties, negative ties. While the structural approach has provided a distinctive niche, social network researchers have not ignored the nature of the relationship. For example, Granovetter's (1973) theory of the "the strength of weak ties" focuses on the time, intimacy, emotional intensity (mutual confiding), and reciprocity characterizing ties (often measured as frequency of interaction). Close friends and family are typically considered strong ties; weak ties are acquaintances. Our close friends are likely to be connected, while our acquaintances are not. Thus, the "strength of weak ties" is that they are likely to be "bridges" to disconnected social circles that may provide useful, non-redundant information (subsequently leading to the above structural hole argument). In work settings, a weak tie might be a link to an

acquaintance in another branch office, which serves as a bridge between the two workgroups. The bridges to disconnected clusters result in the small world phenomenon.

Strong ties, on the other hand, 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 (see also Krackhardt, 1998). Hansen (1999) found that while weak ties were more useful in searching out information, strong ties were useful for the effective transfer of information. On the downside, strong ties require more time and energy to maintain, may provide redundant information, and come with stronger obligations to reciprocate.

Because most relationships are either positive or politely neutral, relatively rare negative relationships may carry more diagnostic power and be given more weight in our social judgment due to negative asymmetry (see Labianca & Brass, 2006 for a summary of this research). This is especially important in the workplace as employees cannot simply avoid negative relationships that may be required due to prescribed workflow or hierarchy. For example, Labianca, Brass and Gray (1999) found that positive relationships (friends in the other groups) were not related to perceptions of intergroup conflict, but negative relationships (someone disliked in the other group) were.

Defined as an “enduring, recurring set of negative judgments, feelings and behavioral intentions toward another person” (Labianca & Brass 2006: 597), they define the “social liabilities” of an actor as a function of four characteristics: strength, reciprocity, cognition, and social distance. Strength refers to the intensity of the relationship from mild distaste to heated hatred. Reciprocity refers to whether one or both parties dislike the other and cognition targets the awareness of each party that the other dislikes him. Social distance is included to note that indirect

ties may also be a source of social liabilities. It refers to whether the negative relationship is direct or whether it involves being connected to someone who has a negative tie to a third party (or extended distance in the network). Being friends with someone who is disliked by others can be a social liability but disliking a person who is disliked by many others may mitigate social liabilities.

Redundant ties. The network approach to the small-world problem and the diffusion of information was subsequently refined to include the notion that networks with ties that bridge across otherwise disconnected clusters result in the diffusion of information more quickly and to more people than networks without such ties. In Granovetter's classic "strength of weak ties" theory, it was the weak ties that bridged across densely-knit clusters and led to non-redundant information that could be used to find jobs (Granovetter, 1973). Focusing on the structure rather than the strength of ties, Burt (2005) notes that bridging across structural holes provides the closure that ensures a small-world. The small-world model of structural holes providing for for-reaching and rapid spread of information works well when considering contagious diseases, or information about job openings, where a single contact is all that is needed for diffusion. However, the adoption of social behavior (such as innovations) may be more complex than the spread of disease (Centola, 2010). Single-contact exposure to a new idea may be insufficient to influence adoption behavior. Redundant exposure via densely connected networks may provide the reinforcement necessary to promote adoption. Supporting this idea are recent experimental findings that adoption of behavior was more likely when participants received "redundant" reinforcement from multiple ties (Centola, 2010).

Although not measured directly, non-redundancy has provided a useful explanation for "the strength of weak ties" (Granovetter, 1973) as well as the advantages of structural holes (Burt, 1992). Redundant ties have been viewed at best as unnecessary or at worst a time-

consuming, wasteful strategy for building effective networks. However, Centola (2010) suggests there may be advantages to redundant ties. In addition to fostering behavioral change, such ties also provide credibility or verification of information and make one less dependent on single sources of such information or other resources (Brass, 1984). In a workflow network, Brass (1984) measured redundant ties as workflow transaction alternatives which had a positive relationship with influence. Redundant ties provide access and control as mentioned above in the *tertius gaudens* example. In addition, redundancy seems consistent with Coleman's (1990) arguments about the social capital benefits (trust, reciprocity, norms) of closed networks. Thus, it may be fruitful for researchers to directly focus on the redundant relationships.

In measuring redundant ties, we have little doubt that weak ties are less redundant than strong ties. Likewise, we would not argue that structural holes provide less redundancy than tightly connected contacts. Both present good proxies for redundancy. Yet, it seems possible that friends may be sources of non-redundant information, or that disconnected contacts may provide the same redundant information. Thus, we propose that redundancy might be fruitfully measured directly in regard to specific resources. In this sense, our focus would be on redundant *content* (what flows through the connections) in place of, or in addition to redundant *positions* in the network.

Our suggested focus on redundant content is similar in some ways to Lin's (2000) focus 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 samples in different countries. While a more complete focus might address the complementarities 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. While Lin's approach emphasizes the status of "who you know," our approach to redundant content focuses on "what they know," and the extent to which that content is redundant. While everyone needs to know a doctor, a mechanic, an accountant, and/or a computer expert, having a redundant backup mechanic provides a second opinion that we often find useful. We can further combine the redundant "second opinion" with the structural assessment of whether your redundant contacts are connected. In most cases, we prefer redundant "second opinions" from actors who are not themselves connected.

Network content. The focus on relationships also includes identifying network content, the domain of possible types of relationships (see Borgatti & Halgin, 2011 for an extended discussion of network content). Burt (1983) noted that people tend to organize their relationships around four categories: friendship, acquaintance, work, and kinship. In other research, network content has been classified as informal versus formal, or instrumental versus expressive. However, interpersonal ties often tend to overlap and it is sometimes difficult to exclusively separate ties on the basis of content. In addition, 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 (Granovetter, 1985). If ties are appropriable, focusing on only one type of relationship may result in important ties being missed in the data. Thus, researchers often measure several different types of content and aggregate across content networks. However, Podolny and Baron (1997) suggest different outcomes from different types of networks, and there is evidence that

people prefer their affective and instrumental ties to be embedded in different networks (Ingram & Zou, 2008) as they represent contrasting norms of reciprocity (see also Casciaro & Lobo, 2008).

Perceptions of Networks. Scholars have also addressed how external perceptions of network ties can influence individual opportunity. Podolny (2001) coined the term “prisms” in contrast to “pipes” and found that audience perceptions of organizational ties relate to their perceptions of the quality of the product services offered by the organizations. At the interpersonal level, Kilduff and Krackhardt (1994) found that individuals who are perceived to have ties to high-status actors (even if such ties do not exist) are perceived as high performers within an organization. However, Krackhardt (1990) found that accurate perceptions of the network were related to power. Halgin (2009) found that the network ties of job seekers are assessed by external audiences to predict how the candidates will behave in the future, thus influencing the hiring process. In addition, Podolny and Morton (1999) found that the network ties of individuals entering the British shipping industry were used to assess the potential cooperativeness of the entrant and thus influenced competitive actions taken against them.

Network Boundaries. In addition to specifying network content, the boundary of the network is an important methodological question. How many indirect links removed from ego should be considered? Based on the research question, what is the appropriate membership of the network? The importance of specifying the boundary is emphasized by Brass’ (1984) finding that centrality within work departments was positively related to power and promotions; centrality within the entire organization was negatively related. More recently, Burt (2007) compared ego-network data with whole network data and found that structural holes beyond ego’s local direct-tie network (“second-hand brokerage”) did not significantly add explained

variance in outcomes in three different samples. Information in organizations tends to be delayed or decays across paths, thus including ties three or four steps removed from ego may be unnecessary. However, several research studies have noted the importance of third-party ties (two-steps removed from ego), and a highly publicized study by Fowler and Christakis (2008) found that a person's happiness was associated with the happiness of people up to three links removed from the person. The effects of indirect ties likely depend on the research question and the outcome variable of interest (see Brass, 2011 for a review).

The conceptual implications of drawing a boundary 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 (not all dance invitations are accepted). 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 who relationships may affect ego. Structural determinism increases to the extent that distant relationships affect ego.

CONCLUSION: Challenges and Opportunities

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. 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, 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. Future research on relationships utilizing network analysis will need to measure the processes and

mechanisms to get a fuller understanding of the value of particular structural patterns of relationships.

While researchers have begun to include personality variables (Mehra, Kilduff & Brass, 2001), previous network research has often 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 (Kilduff & Brass, 2010), 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, Shin, Brass, Choi, Zhang, 2009).

Network scholars have developed a vast array of network measures (see Brass, 2011 for examples) related to important workplace outcomes. Likewise, correlational antecedents of network relationships have been identified (e.g., homophily). However, many questions remain on the dynamics of network relationships – how they change over time. How are relationships maintained and what causes them to decay or be severed (Burt, 2002)? What are the effects of past relationships, and can dormant, inactive, past ties be reactivated? Does the formation of new relationships affect existing ties, and vice versa? Can external agents (i.e., managers) affect the network formation and change of others? Longitudinal research can investigate if and how the traditionally studied content of relationships (e.g., affect) becomes contagious and travels through the network. For example, turnover in organizations may be contagious (Krackhardt & Porter, 1986) as both affect and attitudes are shared by friends. Dyadic conflict or perceptions of injustice or inequality may evolve into organizational schisms as friends take sides in offering support (Shapiro, Brass & Labianca, 2008). Negative relationship at work may carry over into

the home, and vice versa (Hoobler & Brass, 2006). While social networks add a structural approach that extends the dyadic study of relationships, what can social network researchers learn from traditional relationship research? For example, how might network ties be better conceptualized? It is a small world if bridges exist across these disciplinary clusters. Hopefully, this chapter will foster such bridges by energizing collaborative research.

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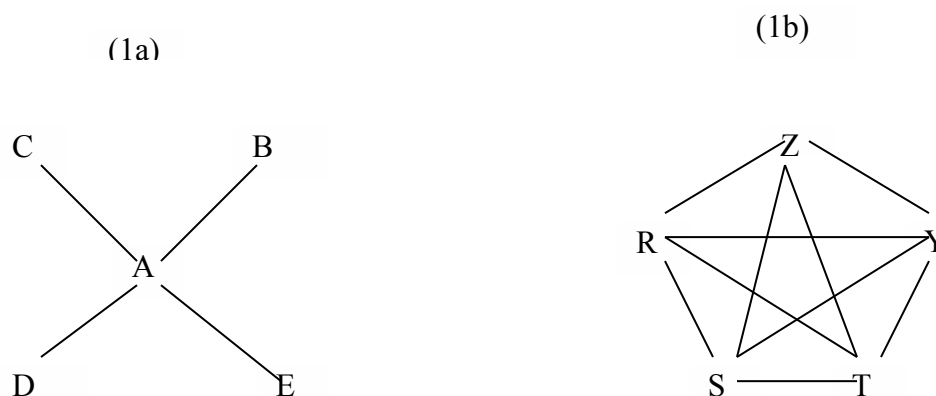


Figure 1.