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Advances in Theory, Research, and Methods

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Emergence of Communication Networks

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Communication networks are the patterns of contact between communication partners that are created by transmitting and exchanging messages through time and space. These networks take many forms in contemporary organizations, including personal contact networks, flows of information within and between groups, strategic alliances between firms, and global network organizations, to name but a few. This chapter examines the theoretical mechanisms that theorists and researchers have proposed to explain the creation, maintenance, and dissolution of these diverse and complex intra- and interorganizational networks. This focus provides an important complement to other reviews of the literature that have been organized on the basis of antecedents and outcomes (Monge & Eisenberg, 1987) or research themes within organizational behavior (Brass & Krackhardt, in press; Krackhardt & Brass, 1994).

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The chapter begins with a brief overview of network analysis, an examination of the relationship between formal and emergent networks, and a brief discussion of organizational forms. The core of the chapter focuses on ten families of theories and their respective theoretical mechanisms that have been used to explain the emergence, maintenance, and dissolution of communication networks in organizational research. These are (a) theories of self-interest (social capital theory and transaction cost economics), (b) theories of mutual self-interest and collective action, (c) exchange and dependency theories (social exchange, resource dependency, and network organizational forms), (d) contagion theories (social information processing, social cognitive theory, institutional theory, structural theory of action), (e) cognitive theories (semantic networks, knowledge structures, cognitive social structures, cognitive consistency), (f) theories of homophily (social comparison theory, social identity theory), (g) theories of proximity (physical and electronic propinquity), (h) uncertainty reduction and contingency theories, (i) social support theories, and (j) evolutionary theories. The chapter concludes with a discussion of an agenda for future research on the emergence and evolution of organizational communication networks.

NETWORK ANALYSIS

Network analysis consists of applying a set of relations to an identified set of entities. In the context of organizational communication, network analysts often identify the entities as people who belong to one *or* more organizations and to which are applied one or more communication relations, such as "provides information to," "gets information from," and "communicates with." It is also common to use work groups, divisions, and entire organizations as the set of entities and to explore a variety of relations such as "collaborates with," "subcontracts with," and "joint ventures with."

Relations in a World of Attributes

Relations are central to network analysis because they define the nature of the communication connections between people, groups, and organizations. This focus stands in sharp contrast to other areas of the social sciences, which have tended to study *attributes,* the characteristics of people, groups, and organizations rather than the relations between them. Relations possess a number of important properties, including the number of entities involved, strength, symmetry, transitivity, reciprocity, and multiplexity. A large literature exists that describes these properties and other fundamentals of network analysis, including network concepts, measures, methods, and applications (see, e.g., Haythornthwaite, 1996; Marsden, 1990; Monge, 1987; Monge & Contractor, 1988; Scott, 1988, 1992; Stohl, 1995; Wasserman & Faust, 1994; Wigand, 1988). Since the focus of this chapter is on theory and research results, it is not feasible to further explore the details of network analysis. However, in addition to the references cited above, Tables 12.1, 12.2, and 12.3 (from Brass, 1995b) summarize major network concepts. These tables describe measures of network ties, measures assigned to individuals, and measures used to describe entire networks.

Network linkages

Network linkages are created when one or more communication relations are applied to a set of people, groups, or organizations. For example, in organizational contexts Farace, Monge, and Russell (1977) identified three distinct important communication networks in terms of production. maintenance, and innovation linkages.

Other kinds of communication linkages are possible. For example, Badaracco (1991) distinguished two types of knowledge, which he called migratory and embedded, each associated with a different type of linkage. Migra-

TABLE 12.1 Typical Social Network Measures of Ties

Measure	Definition	*Example*
Indirect links	Path between two actors is mediated by one or the other	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
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 often used as measure 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	Extent to which relationship is bi-directional	A asks B for advice, and B asks A for advice

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tory knowledge is that information that exists in forms that are easily moved from one location, person, group, or firm to another. Migratory knowledge tends to be contained in books, designs, machines, blueprints, computer programs, and individual minds, all of which encapsulate the knowledge that went into its creation. Embedded knowledge is more difficult to transfer. It "resides primarily in specialized relationships among individuals and groups and in the particular norms, attitudes, information flows, and ways of making decisions that shape their dealings with each other" (Badaracco, 1991, p. 79). Craftsmanship, unique talents and skills, accumulated know-how, and group expertise and synergy are all difficult to transfer from one place to another and particularly difficult to transfer across organizational or even divisional boundaries.

The two types of network linkages Badaracco (199 1) identified were the product link, associated with migratory knowledge, and the knowledge link, associated with embedded knowledge. In the interfirm context, a product link is an arrangement whereby a company relies on "an outside ally to manufacture part of its product line or to build complex components that the company had previously made for itself" (p. 11). Knowledge links are alliances whereby companies seek "to learn or jointly create new knowledge and capabilities" (p. 12). These "alliances are organizational arrangements and operating poli-

TABLE 12.2 Typical Social Network Measures Assigned to Individual Actors

Measure	*Definition*
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-coming 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 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 weight an actor's links to others by 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
Role	
Star	An actor who is highly central to the network
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
Gatekeeper	An actor who mediates or controls the flow (is the single link between one part of the network and another
Isolate	An actor who has no links, or relatively few links to others

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cies through which separate organizations share administrative authority, form social links, and accept joint ownership, and in which looser, more open-ended contractual arrangements replace highly specific, arm's length contracts" (Badaracco, 1991, p. 4).

Research on interorganizational linkages began almost 40 years ago with the work of Levine and White (1961) and Litwak and Hylton (1962), which spawned a quarter century's worth of interest on the exchange of goods and material resources (see, e.g.,

TABLE 12.3 Typical Social Network Measures Used to Describe Networks

Measure	*Definition*
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
Connectivity (reachability)	Extent to which actors in the network are linked to one another by direct or indirect ties. Sometimes measured by the maximum, or average, path distance between any two actors in the network
Connectedness	Ratio of pairs of nodes that are mutually reachable to total number of pairs o 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 all 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
Symmetry	Ratio of number of symmetric to asymmetric links (or to total number of links) in a network
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)

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Mitchell, 1973; Warren, 1967). More recent work has focused on communication, information, and knowledge linkages (Gulati, 1995). Eisenberg et al. (1985) developed a two-dimensional typology of interorganizational linkages based on linkage content and linkage level. The content dimension separated material content from symbolic or informational content. The level dimension distinguished three forms of exchange. Eisenberg et al. (1985) state:

> An *institutional* linkage occurs when information or materials are exchanged between organizations without the involvement of specific organizational roles or personalities (e.g., routine data transfers between banks). A *representative* linkage occurs when a role occupant who officially represents an organization within the system has contact with a representative of another organization (e.g., an interagency committee to formulate joint policies). The emphasis here is on the official nature of the transaction and the representative capacities of the individuals. Finally, a *personal* linkage occurs when an individual from one organization exchanges information or material with an individual in another organization, but

in a nonrepresentative or private capacity (i.e., via friendship or "old school" ties). (p. 237, emphasis in the original).

Formal Versus Emergent Networks

Historically, organizational communication scholars have made important theoretical and empirical distinctions between formal and emergent networks. Theoretically, the notion of "emergent network" was a designation that originally differentiated informal, naturally occurring networks from formal, imposed, or "mandated" networks (Aldrich, 1976), the latter of which represented the legitimate authority of the organization and were typically reflected by the organizational chart. The formal networks were presumed to also represent the channels of communication through which orders were transmitted downward and information was transmitted upward (Weber, 1947). Early organizational theorists were aware that the formal organizational structure failed to capture many of the important aspects of communication in organizations and discussed the importance of informal communication and the grapevine (Barnard, 1938; Follett, 1924). Several scholars developed ways to study the grapevine and informal networks such as Davis's (1953) episodic communication in channels of organizations (ECCO) analysis, a technique for tracing the person-to-person diffusion of rumors or other items of information in an organization.

Researchers have provided considerable evidence over the years for the coexistence of the two networks. For example, using a variant of ECCO analysis, Stevenson and Gilly (1991) found that managers tended to forward problems to personal contacts rather than to formally designated problem solvers, thus by-Passing the formal network. Similarly, Albrecht and Ropp (1984) discovered that "workers were more likely to report talking about new ideas with those colleagues with whom they also discussed work and personal matters, rather than necessarily following prescribed channels based upon hierarchical role relationships" (p. 3). Stevenson (1990) argued that the influence of formal organizational structure on the emergent structure could be best understood on the basis of a status differential model. In a study of a public transit agency, he found evidence that the social distance across the hierarchy reduced the level of communication between higher- and lower-level employees, with middle-level employees serving as a buffer.

An important rationale for studying emergent communication networks has evolved out of the inconclusive findings relating formal organizational structure to organizational behavior (Johnson, 1992, 1993; see also McPhee & Poole, Chapter 13, this volume). Jablin's (1987) review of the empirical research on formal organizational structures pointed to the inconclusive nature of studies involving structural variables such as hierarchy, size, differentiation, and formalization. More recently, a series of meta-analytic studies has concluded that the relationships between formal structure, organizational effectiveness (Doty, Glick, & Huber, 1993; Huber, Miller, & Glick, 1990), and technology (Miller, Glick, Wang. & Huber, 1991) are largely an artifact of methodological designs. The fact that formal structural variables have failed to provide much explanatory power has led several scholars to argue that emergent structures are more important to study than formal structures because they better contribute to our understanding of organizational behavior (Bacharach & Lawler, 1980; Krackhardt & Hanson, 1993; Krikorian, Seibold, & Goode, 1997; Roberts & O'Reilly, 1978; Roethlisberger & Dickson, 1939).

These problems with formal structures and the recent priority given to emergent structure have prompted scholars to develop network measures that capture in emergent networks the key concepts used to describe formal organizational structure. For example, Krackhardt (1994) has developed four measures of informal structure-connectedness, hierarchy, efficiency, and least-upper-boundedness (unity-of-command)-that map onto theories of an organization's formal organizational structure.

Further, the increased use of new computer-mediated communication systems has spawned research that uses formal organizational structure as a benchmark against which to compare communication networks that emerge in an electronic medium. Several interesting, though somewhat conflicting, findings have emerged. In a two-year study of over 800 members of an R&D organization, Eveland and Bikson (1987) found that electronic mail served to augment, and in some cases complement, formal structures. On the other hand, Bizot, Smith, and Hill (1991) found that electronic communication patterns corresponded closely to the formal organizational structures in a traditionally hierarchical R&D organization. Lievrouw and Carley (199 1) argued that new communication technologies might usher in a new era of "telescience" by offering alternatives to the traditional organizational structures in universities and industry. However, Rice (1994b) found that the electronic communication structures initially mirrored formal organizational structures, but these similarities diminished over time. Hinds and Kiesler (1995) explored the relationship between formal and informal networks in a telecommunications company. They found that communication technologies were increasingly used as a tool for lateral communication across formal organizational boundaries; this finding was most pronounced for technical workers.

The literature comparing face-to-face or mediated emergent communication structures with formal structures generally demonstrates a "pro-emergent bias." That is, the theory and empirical evidence focus on the advantages of informal communication to individuals and organizations. However, Kadushin and Brimm (1990) challenged the assumption that three types of emergent networks, (a) the shadow networks (the "real" way things get done), (b) the social interaction networks, and (c) the career networks (the venue for so-called networking) always serve to augment the limitations of the organization's formal network. Instead, they argued that these three informal networks frequently work at cross-purposes, thereby restricting rather than promoting the organization's interests. In a study of senior executives in a large, international high-technology company, they found that by saying, "Please network, but don't you dare bypass authority," organizations create what Bateson (1972) called a "double bind," a choice situation where each alternative conflicts with the others. They argued that "an important first step is to recognize the incompatibilities between emergent network structures and corporate authority structures and to move this inconsistency from the realm of double bind to the domain of paradox" (Kadushin & Brimm, 1990, p. 15).

Clearly, there is continuing scholarly interest in the study of the differences between formal and emergent networks in organizations. Ironically, however, the distinction between formal and informal structures in organizations has diminished significantly in recent years and may become increasingly irrelevant in the coming decade. Reasons for this center on shifts in organizational structure and management philosophy. Prominent among these are changes to more team-based forms of organizing, the adoption of matrix forms of organizational structure (Burns & Wholey, 1993), and shifts to network forms of organizing (Miles & Snow, 1986, 1992, 1995; Monge, 1995). At the core of these changes has been the explosion of lateral forms of communication (Galbraith, 1977, 1995) made possible by new information technologies that facilitate considerable point-to-point and broadcast communication without regard for traditional hierarchy.

These developments have eroded the distinction between prior structural categories used to characterize organizations, specifically, between formal and informal and/or between formal and emergent. Contrary to traditional views, contemporary organizations are increasingly constructed out of emergent communication linkages, linkages that are ephemeral in that they are formed, maintained, broken, and reformed with considerable ease (Palmer, Friedland, & Singh, 1986). As Krackhardt (1994) says,

> An inherent principle of the interactive form is that networks of relations span across the entire organization, unimpeded by preordained formal Structures and fluid enough to adapt to immediate technological demands. **These** relations can be multiple and complex. But one characteristic they share is that they *emerge* in the organization, they are not preplanned. (p. 218, emphasis in the original)

The networks that emerge by these processes and the organizations they create are called network and organizational forms. Both are reviewed in the following section.

Network and Organizational Forms

Communication network patterns that recur in multiple settings are called *network forms.* An early theoretical article by Bavelas (1948) based on Lewin's (1936) psychological field theory identified a number of small-group communication network forms in organizations, including the chain, circle, wheel, and comcon (completely connected), and theorized about how the different forms processed information. These network forms varied in the degree to which they were centralized, with the wheel being the most centralized and the comcon the least centralized.

This theoretical article and an imaginative experimental design created by Leavitt (19.5 1) generated hundreds of published articles over some 25 years. The primary focus of these efforts was the impact of information processing via the different network forms on productivity and satisfaction (see Shaw, 1964, for a review of this literature). Two prominent findings emerged from this research. First, centralized organizations were more efficient for routine tasks, while decentralized networks were more efficient for tasks that required creativity and collaborative problem solving. Second, people in decentralized organizations were more satisfied with the work processes than people in centralized organizations, with the exception in the latter case that the central person in centralized networks was extremely satisfied. Unfortunately, little further theoretical development accompanied this plethora of empirical research. As a result, this line of inquiry has essentially died; almost no articles have been published on small-group network forms in organizations during the past 20 years.

Organizational structures, including communication networks, that share common features or patterns across a large number of organizations are called ***organizational forms*** (McKelvey, 1982). Weber (1947) argued that bureaucracy was the universal organizational form. Three principal theoretical mechanisms that created bureaucracy were rationalization, differentiation, and integration. Rationalization occurred by specifying legitimating instructions that produced standard operating procedures, thus leaving little opportunity for individual autonomy. Rationalizing the network meant specifying who could say what to whom, often summarized by the injunction that commands should flow downward and information upward in the bureaucracy. Differentiation was the process of breaking work up into its various components. This often led to job specialization particularly as production processes proliferated and increased in size and complexity. As work became differentiated, the various parts needed to be coordinated, and thus processes of integration came into operation. Weber argued that bureaucracy differentiated along vertical organizational lines and primarily integrated that way as well. Bureaucracy allowed little room for lateral, cross-level, or cross-boundary communication networks, that is, informal or emergent networks, a feature for which it has been frequently criticized (Heckscher, 1994).

Miles and Snow (1986, 1992) identified four major organizational forms that have developed over the past century: (a) the traditional functional form, which emerged during the early part of the century; (b) the divisional (or multidivisional) form, which was begun by Alfred P. Sloan at General Motors in the 1940s (see Chandler, 1977); (c) the matrix form, which evolved during the 1960s and

1970s; and (d) the network form, which has emerged over the past decade. Miles and Snow (1992) argue that each of these forms contains its own operating logic, or in terms of this chapter, theoretical mechanism. The functional form uses a logic of "centrally coordinated specialization" (p. 58), which enables it to efficiently produce a limited set of standardized goods or services for a stable, relatively unchanging market. The divisional form operates by a logic of "divisional autonomy with centrally controlled performance evaluation and resource allocation" (p. 60). Divisions produce separate products or focus on separate markets but are collectively accountable to centralized authority through their communication networks. The ability to develop new divisions enables the multidivisional form to pursue new opportunities in changing markets. The matrix form combines the operating logic of functional and multidivisional forms, using the functional form to produce standardized goods and services and the shared resources of the multidivisional form to explore new opportunities via project groups or teams. The network form uses flexible, dynamic communication linkages to connect multiple organizations into new entities that can create products or services.

THEORETICAL MECHANISMS TO EXPLAIN THE EMERGENCE OF NETWORKS

Communication network analysis falls within the intellectual lineage of structural analysis, which has had a long and distinguished history. In sociology, Herbert Spencer (1982) and Émile Durkheim (1895/1964) are often credited with introducing structural concepts into sociological thinking. In anthropology, Radcliffe-Brown (1952/1959) incorporated structural-functionalist ideas into his watershed analysis of cultures. And in linguistics, structural thinking can be traced to the pioneering work of de Saussure (1916/1966). Most structural analyses of organizations and communication can be located in one of three traditions: positional, relational, and cultural.

The *positional* tradition is rooted in the classical work of Max Weber (1947), Talcott Parsons (1951), and George Homans (19.58). Organizational structure is viewed as a pattern of relations among positions. Sets of Organizational roles are associated with positions and specify designated behaviors and obligatory relations incumbent on the people who assume the positions. The positions and attached roles constitute the relatively stable and enduring structure of the organization independent of the people who fulfill the roles. This tradition leads to the view that positions and roles determine who communicates with whom, and consequently, the communication structure of the organization. White, Boorman, and Breiger (1976) and Burt (1982) have developed the most significant recent positional theories applicable to organizational communication under the rubric of structural equivalence. This theory argues that people maintain attitudes, values, and beliefs consistent with their organizational positions irrespective of the amount of communication that they have with others in their organizational networks. The positional tradition has been criticized for its inability to take into account the active part individuals play in creating and shaping organizational structure (Coleman, 1973; Nadel, 1957; White et al., 1976).

The *relational* tradition focuses primarily on the direct communication that establishes and maintains communication linkages. Taken collectively, these linkages create an emergent communication structure that connects different people and groups in the organization irrespective of their formal positions or roles. Rooted in systems theory (Bateson, 1972; Buckley, 1967; Watzlawick, Beavin, & Jackson, 1967), the relational tradition emphasizes the dynamic, constantly changing, enacted nature of structure created by repetitive patterns of person-to-person message flow. Rogers and Kincaid (195 1) claim that it

is the dominant tradition in organizational communication.

The *cultural* tradition examines symbols, meanings, and interpretations of messages transmitted through communication networks. As part of the resurgence of interest in organizational culture (Frost, Moore, Louis, Lundberg, & Martin, 1985), much of the work has been based on Giddens's (1976, 1984) writings on structuration, which attempt to account for both the creative and constraining aspects of social structure. These studies are characterized by an explicit concern for the continual production and reproduction of meaning through communication, examining simultaneously how meanings emerge from interaction and how they act to constrain subsequent interaction. The cultural tradition has spawned recent work on semantic networks (Monge & Eisenberg, 1987) described later in this chapter. These three traditions are discussed in greater detail in Monge and Eisenberg (1987).

Although interesting and useful, these network traditions focus attention at a metatheoretical level and fail to specify the *theoretical mechanisms* that describe how people, groups, and organizations forge, maintain, and dissolve linkages. Further, while a number of scholars over the past decade have called for greater explication of network theory (e.g., Rogers, 1987; Salancik, 1995; Wellman, 1988), almost none have provided it. Finally, while several reviewers have identified theories that are applicable to network research within and between organizations (Brass & Krackhardt, in press; Galaskiewicz, 1985; Grandori & Soda, 1995; Mizruchi & Galaskiewicz, 1994; Smith, Carroll, & Ashford, 1995), none have systematically explored the theories and their theoretical mechanisms.

This chapter addresses these omissions in the organizational communication network literature by focusing on the role of theory and theoretical mechanisms in explaining the emergence of communication networks. More Specifically, it examines the extant organizational literature using a network perspective with special attention to the mechanisms that help explain the *emergence* of networks. This review will demonstrate that a wide array of theories is amenable to network formulations. In some cases, different theories, some using similar theoretical mechanisms, offer similar explanations but at different levels of analysis. The review will also underscore the considerable variation in the depth of conceptual development and empirical research across the different theories and theoretical mechanisms. Since the chapter focuses on theoretical mechanisms, many other interesting network articles that have little or no bearing on these issues have not been included. The theories and their theoretical mechanisms are summarized in Table 12.4.

Theories of Self-Interest

Social theorists have long been fascinated by self-interest as a motivation for economic and other forms of social action (Coleman, 1956). Theories of self-interest postulate that people make what they believe to be rational choices in order to acquire personal benefits. The strong form of this theoretical mechanism stipulates that people attempt to maximize their gains (or minimize their losses). The weaker theoretical form says that people "satisfice" rather than maximize, which means that people choose the first good alternative they find rather than exploring all alternatives and selecting the best. Two theories of self-interest that have been used to explore communication network issues are examined in this section: the theory of social capital and transaction cost economics theory.

Theory of Social Capital

The deployment of social capital (Coleman, 1988) in networks is best represented in Burt's (1992) theory of structural holes. This theory argues that people accumulate social resources, or "social capital," which they in-

TABLE 12.4 Ten Families of Theories and Their Theoretical Mechanisms to Explain the Emergence of Networks

Theories	*Theoretical Mechanisms*	*Relevant Organizational Variables*
1. Theories of self-interest		Employee autonomy, flexibility
Theory of Social Capital	Investments in opportunities	**Employee effectiveness**
Theory of Structural Holes	**Control of information flow**	**Employee efficiency**
Transaction Cost Economics Theory	Cost minimization	Organizational innovation
		Coordination by markets and hierarchies
2. Theories of mutual self-interest and collective action	Joint value maximization	Contributions to collective good
Public Goods Theory	**Inducements to contribute**	Mobilization of resources
Critical Mass Theory	**Number of people with resources and interests**	Adoption of innovations
3. Exchange and dependency theories	Exchange of valued resources (material or information)	Power, leadership
Social Exchange Theory		Trust and ethical behavior
Resource Dependency Theory		Interorganizational linkages
Network Organizations		**Coordination by networks**
		Virtual organizing
4. Contagion theories	Exposure or contact leading to:	**General workplace attitudes**
Social information Processing Theory	Social influence	**Attitudes toward technologies**
Social Learning Theory	Imitation, modeling	Behavior through contagion
Institutional Theory	**Mimetic behavior**	Interorganizational contagion
Structural Theory of Action	Similar positions in structure and roles	
5. Cognitive theories	Cognitive mechanisms leading to:	Shared interpretations on key organizational concepts
Semetic and Knowledge Networks	Shared interpretations	Shared atrributions of other individuals
Cognitive Social Structures	Similarity in perceptual structures	Shared perceptions of the social structure
Cognitive Consistency theories	**Drive to restore balance**	Workplace attitudes such as satisfaction
Balance Theory	Drive to reduce dissonance	Workplace behaviors such as turnover
Theory of Cognitive Dissonance		

6. Homophily theories Social Comparison Theory Social Identity Theory	Choose similar others as basis of comparison Choose categories to define one's own group identity	Demographic variables such as age, tenure, gender, and race
7. Theories of physical and electronic proximity Physical Proximity Electronic Proximity	Influence of distance Influence of accessibility	Workplace attitudes
8. Uncertainty reduction and contingency theories Uncertainty Reduction Theory Contingency Theory	Choose communication links to reduce uncertainty	Communication about innovation Organizational structural characteristics Introduction of new technologies Market exchanges Interorganizational conflict
9. Social support theories	Choose communication links to gain or mobilize social resources	Buffer social and psychological stress Coping with stress General workplace attitudes
IO. Theories of network evolution Structuration Theory Computation and Mathematical Organizational Theory Organizational Life Cycle and Developmental Theories	Selection and retention Duality of structure Nomothetic non-linear generative mechanisms Evolution of structures as a function of life-cycle stages	Foundings and extinctions Change in network configurations, role configurations, appropriation of new structures and media

vest in social opportunities from which they expect to profit. These investments are largely motivated by self-interest, defined as the return people expect to get on the social capital they invest. Network "holes" are those places in a network where people are unconnected. Consequently, holes provide opportunities where people can invest their social capital. To invest in, fill, or exploit these holes, people link directly to two or more unconnected others, thus creating indirect ties between the people to whom they link. People who link others by filling structural holes also enhance their own structural autonomy because they can control the information that flows between others. Consequently, Burt (1992) argues that the diversity of individuals' networks is a better predictor of their social capital than network size. Researchers have examined the relationships between social capital and organizational effectiveness, efficiency, and innovation. Each area is reviewed below.

Social capital and effectiveness. Researchers (Benassi & Gargiulo, 1993; Burt, 1992) have argued that network linkages enable and constrain the flexibility, autonomy, and therefore, the effectiveness of organizational members. Consistent with Burt's (1992) argument, Papa (1990) found that organization members with diverse networks across departments and hierarchical levels were significantly more likely to both increase productivity and hasten the speed with which this change occurred. Similarly, Burt (1992) found that the occurrence of structural holes in managers' networks was positively correlated with managerial effectiveness. However, he notes that this finding was not supported among female managers and recent recruits, where effectiveness was correlated with strong ties to others, Ibarra and Andrews's (1993) research showed that individuals who were central in the advice and friendship networks were more likely to perceive autonomy in their work. Benassi and Gargiulo (1993) found that the flexibility of managers in an Italian subsidiary of a multinational computer manufacturer significantly affected their likelihood of success in coordinating critical interdependencies. Managers were rated as having high flexibility if (a) their communication networks were constrained by a low level of aggregate interdependencies and consultations with others in their network, and (b) their communication network had structural holes among the people imposing these constraints. More recently, Burt (1997) reports that social capital is especially valuable for managers with few peers because such managers do not have the guiding frame of reference provided by numerous competitors, or the legitimacy provided by numerous people doing the same kind of work (p. 356). In addition, Burt (1991) has developed computational measures of "structural autonomy" to assess the level and distribution of constraints affecting individuals in a network.

Walker, Kogut, and Shan (1997) tested Burt's theory of structural holes at the interorganizational level. Their research showed that developing and nurturing social capital in the biotechnology industry was a significant factor in "network formation and industry growth" (p. 109). In the development of enduring relationships, firms choose to increase social capital rather than exploit structural holes. However, they argue that "structural hole theory may apply more to networks of market transactions than to networks of cooperative relations" (p. 109). In the case of market transactions, firms are not bound by the structural constraint to cooperate over time and may therefore be more inclined to exploit structural holes.

In related research, Baker (1987) found that organizations with low levels of debt improved their autonomy in managing transactions by establishing communication relationships with many, rather than one or a few, investment banks. Kosnik (1987) found that companies who had more outside directors, especially directors from firms that had transactions with the focal firm, had less autonomy in engaging in "greenmail," the private repurchase of company stock. In contrast, the

CEOs of firms that had more outside directors had greater autonomy in negotiating "golden parachute" policies for the firms' top executives (Cochran, Wood, & Jones, 1985; Singh & Harianto, 1989; Wade, O'Reilly, & Chandratat, 1990).

Social capital and efficiency. Granovetter's (1982) theory of the "strength of weak ties" was also based on the premise that the people with whom a person has weak ties are less likely to be connected to one another; that is, the person is embedded in a structural hole. Consequently, the information obtained from these weak ties is less likely to be redundant and more likely to be unique, thereby making weak ties "information rich." Burt (1992) argued that being embedded in a structural hole allows actors to be more efficient in obtaining information. Using data from the 1985 and 1987 General Social Survey, Carroll and Teo (1996) found that the members of managers' core discussion networks were less likely to be connected to one another than members of nonmanagers' networks; consequently, nonmanagers' core discussion networks were less efficient in obtaining information. Contrary to conventional wisdom, Granovetter (1982) found that individuals were more likely to find jobs through their weak ties than through strong ties or formal listings. However, Lin, Ensel, and Vaughn's (1981) research showed that weak ties were effective only if they connected individuals to diverse others who could provide nonredundant information.

Social capital and innovation. The diversity of information obtained from ties has also been used to explain the introduction of innovations in organizations. Rogers (1971) noted that innovations were more likely to be introduced to an organization by cosmopolites, that is, people with diverse networks, including several external to the organization. In a study of the inventory and control systems of manufacturing industries, Newell and Clark (1990) reported that British firms were less innovative than their U.S. counterparts in part because they were less central in their interorganizational communication networks. More recently, Burns and Wholey (1993) found that hospitals that were centrally located in an interorganizational network were more likely to be early adopters of an innovation (the matrix form of management) than other hospitals in their network. Brass (1995a) suggested that being embedded in networks with structural holes can also enhance employees' ability to provide creative solutions to organizational problems.

Extensions to social capital. Since the introduction of the "social capital" concept in 1988 by Coleman, an impressive body of theoretical and empirical evidence has demonstrated its relevance. It was developed as a concept distinct from "human capital," which focuses on the attributes of individuals, such as seniority, intelligence, and education. Many of the informal means by which individuals accrue social capital rely on their knowledge of the existing communication networks. However, as the workforce moves from being physically co-located to "virtual environments," it is unclear whether electronic forms of communication such as email, which provide such things as distribution lists and records of messages, make it easier or more difficult for individuals to assess the existing social structure. Hence, as scholars examine the workforce of the 21st century, there is a pressing need for research that examines the distinctive strategies by which individuals can identify structural holes and thereby accumulate social capital in virtual organizations.

Transaction Cost Economics Theory

From the viewpoint of traditional economic theory, the market was the classical organizational form, where buyers and sellers communicated their intentions to each other, and where supply and demand were presumed to determine prices for goods. This is the purest form of self-interest theory. By contrast,

neoclassical economics examined the development of hierarchical and vertically integrated forms as a more efficient alternative to markets (Coase, 1937), though one that is equally self-interested. However, over the past decade important changes in theories and views of organizational structuring have been occurring. A new organizational form, the network organization, is emerging as an alternative to both markets and vertically integrated organizations. This section examines these two traditional organizational forms, the market and hierarchies; the following section explores the development of the new alternative, the network form.

Williamson (1975, 1985) developed transaction cost economics to explain the organization of economic activity. All organizations require raw materials or components to manufacture their own goods or services. Thus, Williamson argued, organizations face a choice between buying resources from other firms or acquiring other firms in order to make the suppliers' goods or services at lower costs than what they could buy them, what is frequently called the buy-or-make decision. (It is also possible to develop internal capabilities, but this is generally seen as a more expensive option.) Williamson viewed the first alternative as governed by market mechanisms, where an organization hunts for the best prices among the alternative supplier firms. "Transaction costs" are the expenses associated with finding information about prices and quality from the available firms and negotiating contracts. He saw the second alternative, vertical integration, as governed by hierarchical forces, the administrative costs, including communication, associated with managing the internal production of acquired supplier firms. Economic organizations, Williamson argued, attempt to minimize transaction costs by making a choice between markets and hierarchies. Vertical integration, he said, is the efficient alternative when the transaction costs for markets are greater than the administrative costs of production through hierarchical ownership (Zajac & Olsen, 1993, p. 133). Clearly, the theoretical mechanism in Williamson's theory is efficient self-interest. Organizations make self-interested choices among alternative organizational forms by attempting to minimize the communication, information search, and decision-making costs associated with finding sellers in the market or acquiring suppliers. It should be clear that this mechanism is centered very much in the decision framework of individual firms. The alternative forms generated by this mechanism differ considerably in the nature of their communication networks.

Gupta and Govindarajan (199 1) have extended Williamson's theory to the arena of multinational corporations. They argued that governance in multinational corporations can be viewed as a network of transaction cost exchanges. Home offices govern subsidiaries by regulating three critical transaction flows: capital, product, and knowledge. The fact that subsidiaries are located in different countries creates different strategic contexts and communication problems that determine the magnitude and direction of transaction flows.

A number of criticisms have been leveled against transaction cost economics. Granovetter (1985) observes that analyses of human and organizational economic behavior generally cluster at two ends of a continuum. Traditional neoeconomics treats human behavior and institutional action independent of social relations and interpersonal communication, a view that Granovetter calls an undersocialized viewpoint. More reformist economists and sociologists (e.g., Piore, 1975) tend to see economic action as severely constrained by social influences, a position he calls an oversocialized view. By contrast, Granovetter argues for a third alternative, that economic behavior of both individuals and organizations occurs within existing communication structures and ongoing social relations, a position he calls the embedded view. "The embeddedness argument," he says, "stresses instead the role of concrete personal relations and structures (or 'networks') of such relations" (p. 490). This view was supported by Uzzi's (1996) study of New York dress apparel firms, which showed that "embed-

ness is an exchange system with unique portunities relative to markets and that ms organized in networks have higher sur- al chances than do firms which maintain m's-length market relationships" (p. 674).

Of course, there are drawbacks to embed- &. Just as theory about the behavior of ividual people or organizations can be over- or undersocialized, so can organizations be overembedded or underembedded. As rabher (1993) says, "Too little embed- %& may expose networks to an erosion of their supportive tissue of social practices and institutions. Too much embeddedness, how- ever, may promote a petrifaction of this sup- port&e, tissue and, hence, may pervert net- works into cohesive coalitions against more radical innovations" (pp. 25-26). Similarly, Uzzi" (1997), recognizing the paradox of embeddedness in the New York apparel econ- omy, identified three conditions that turn embeddedness into a liability: "(1) There is an u&reseeable exit of a core network player, (2&institutional forces rationalize markets, or (3) overembeddedness characterizes the net- work" (p. 57).

@Another criticism developed by Gran- ovetter (1985) and Powell (1990) is that the dichotomy between markets and hierarchies does not exhaust all of the important organiza- tional forms. Lazerson (1993) claims that "the false promises of vertical integration have stimulated interest in alternative organiza- tional forms that are neither hierarchies nor markets" (p. 203). Williamson (1985, 1991) acknowledged this possibility in his discus sion of alliances as hybrid forms. These, he said, exist between the other two and occur when the transaction costs associated with market exchange are too high but not high enough to justify vertical integration. How- %% a number of scholars, including Powell (1990), have argued that at least one alterna- tive, the network organization, is neither mar- ket nor hierarchy in form. This issue is dis- cussed in a later section of the chapter.

Zajac and Olsen (1993) critiqued William- son's perspective on two accounts. First, they pointed out that Williamson's analysis fails to account for communication and other pro- cesses encountered in the transaction costs analysis. Instead, they proposed an alternative three-stage process that they argue enables firms to determine whether they should enter into the relation. These three are the initial- izing stage, the processing stage, and the reconfiguring stage. During the first stage each potential partner to the relation deter- mines its own objectives, reviews exchange alternatives, and begins exploratory contacts to examine the feasibility of the relationships. Here, Zajac and Olsen (1993) contend, the first rounds of exchange "often take the form of preliminary communication and negotia- tion concerning mutual and individual firm in- terests, and/or feasibility studies and general information exchange" (p. 139). During the second stage firms engage in both serial and parallel information processing, "interfirm communications . . . occurring between indi- viduals at multiple organizational levels and multiple functional areas" (p. 140). The third stage, reconfiguration, consists of evaluation of the relationship followed by a return to ei- ther of the previous two stages to (a) seek rela- tional changes or (b) reaffirm the status quo. In essence, this stage affirms the information and communication network linkages on which the organizational relations can be es- tablished.

The second problem they identified is that Williamson's view of transaction cost min- imization takes the perspective of only one or- ganization. This is an error, they claimed, be- cause a relationship has two sides, both of which should be included in any comprehen- sive account. Thus, they argued that transac- tion cost minimization from the perspective of one firm be replace by a "joint value maximi- zation principle" that focuses on the benefits to both (or multiple) firms. More specifically, they propose that "value estimations of interorganizational strategies require that a fo- cal firm consider the value sought by that firm's exchange partner. By taking the part- ner's perspective, the focal firm can better es-

timate the value and duration of the interorganizational strategy, given that value and duration are determined interdependently by other firms" (p. 137).

It is worth noting that Zajac and Olsen's critique transforms the self-interest theoretical mechanism for creating organizational communication networks into one that is jointly rather than individually self-interested. Further, it attempts to maximize collective value rather than minimize individual costs. This theoretical mechanism to account for the emergence of communication networks, mutual self-interest, is reviewed more fully in the following section.

Theories of Mutual Self-Interest and Collective Action

Collective action is a term that has been broadly applied to a wide range of phenomena in the social sciences, including organizational communication (Coleman, 1973). Its main focus is on "mutual interests and the possibility of benefits from coordinated action" (Marwell & Oliver, 1993, p. 2) rather than on individual self-interests. Samuelson (1954) first articulated public goods theory to explain how people could be induced to contribute to collective goods in the public domain such as bridges, parks, and libraries. Applications of this perspective to the interactive communication public goods of connectivity and communality have been made recently by Fulk, Flanagin, Kalman, Monge, and Ryan (1996).

The logic of collective action is based on the assumption that individuals motivated by self-interest will avoid investing resources in a joint endeavor whenever possible, leaving others to contribute their share even though all will benefit (Olson, 1965). This phenomenon is known as "free riding." Peer pressure is often applied to overcome this tendency to free ride and serves to make individuals comply with the need to contribute their fair share, thus facilitating collective action. Original formulations treated individuals as if they were isolated and independent of others making similar decisions. Oliver (1993), Markus (1990), and Marwell and Oliver (1993) have criticized this view and emphasized the importance of the network of relations in which people are embedded. Computer simulation experiments by Marwell and Oliver (1993) showed that the extent to which people are interconnected in communication network increases their willingness to support the collective good. Using a similar research strategy, Marwell, Oliver, and Prahl (1988) showed that centralization and resource heterogeneity in the network influenced aggregate contributions to a collective good.

Empirical studies using collective action as an explanatory mechanism fall into two categories: the group's mobilization as indexed by its level of involvement, and the adoption of innovations. Research using a collective action mechanism has focused on the effect of the network on mobilization, as well as more specifically the adoption of innovations. Each of these two areas is discussed below.

Collective Action and Mobilization

In a retrospective study of the insurgency in the Paris Commune of 1871, Gould (1991) underscored the importance of examining multiple, partially overlapping networks in explaining the insurgents' solidarity and commitment. He found that the

> importance of neighborhood identity and the patterns of arrests showed that preexisting social ties among neighbors and organizational ties formed by the National Guard worked together to maintain solidarity in the insurgent ranks.. . , Cross-neighborhood solidarity could not have emerged in the absence of enlistment overlaps that linked each residential area with Guard units in other areas. (p. 727)

Applied to organizational contexts, Gould's findings suggest that collective action is less likely to succeed if the informal networks are structured so as to be either isomorphic with

preexisting formal ties, or if they "completely cut across preexisting networks" (p. 728).

Knoke (1990, p. 5) examined the determinants of member participation and commitment among 8,746 respondents from 35 "collective action organizations," professional associations, recreational clubs, and women's associations. He discovered that "members' involvements in their collective action organizations are enhanced by extensive communication networks that plug them into the thick of policy discussions, apart from whatever degree of interest they may have in particular policyissues" (p. 185). At the interorganizational level, Laumann, Knoke, and Kim (1985) found that health organizations central in their industry's communication networks were more involved in mobilizing efforts on national policy issues affecting their domain. However, this relationship did not hold up among organizations in the energy industry. Laumann et al. (1985) concluded that centrality in a communication network was more important in predicting collective action in industries that were less institutionalized.

Collective Action and the Adoption of Innovations

Theories of collective action have also been used to examine the adoption of new interactive communication technologies (Markus, 1990; Rafaeli & LaRose, 1993). Valente (1995, 1996) has examined the effect of "threshold" (Granovetter, 1978) on adoption behavior. The *threshold* is defined as the number of other adopters that must be present in a person's network before the person decides to adopt. The threshold levels of individuals determine whether the group as a whole can achieve the critical mass necessary for rapid and widespread collective action. Rice, Grant, Schmitz, and Torobin (1990) examined the role of critical mass in predicting the adoption of an electronic mail system at a decentralized federal agency. They found that individuals' decisions to adopt the system were contingent on the decisions of others with whom they reported high levels of task interdependence. Further, individuals' adoption decisions were influenced by the extent to which they valued the potential communication with others who were likely to be accessible via the new system. Gurbaxani (1990) used an adoption model based on critical mass theory to predict with considerable accuracy university adoption of the Bitnet computer network. At the interorganizational level, studies on governmental and nonprofit organizations have examined the role of network ties in overcoming obstacles to collective action (Mizruchi & Galaskiewicz, 1993; Rogers & Whetten, 1982; Turk, 1977).

Extensions lo Collective Action Theory

The interest in examining the emergence of networks from a collective action perspective is relatively recent. It has been used persuasively to address issues of mobilization and the adoption of innovation. However, unlike some other mechanisms discussed in this chapter, the theoretical developments in this area have not been well complemented by empirical evidence. Scholars have proposed mathematical models, and some have carried out simulations. However, few of these efforts have been empirically validated.

In addition to the need for more empirical research, there are also some conceptual issues that continue to be advanced. First, the conceptualization of information technologies, such as discretionary databases, as "public goods" (Fulk et al., 1996), suggests that collective action theories can offer a more sophisticated explanation of the emergence of organizational networks, extending their present use to study the adoption of technologies in organizations. Discretionary databases are the message repositories that link knowledge suppliers and consumers, thereby creating connective and communal networks of individuals who share knowledge domains.

Second, there is potential for the application of network approaches to the conceptualization of free riding and its role in collective action. Collective action by groups is based on

an underlying premise of social control. Homans's (1974) cohesion-compliance hypothesis predicts that group members are able to enforce social control on one another by exchanging peer approval for compliance with group obligations. Flache and Macy (1996) argue that under some circumstances members may choose to offer peer approval in exchange for peer approval rather than compliance from others. Using computer simulations of groups' networks, they observed that in these situations groups may reach a high level of cohesion that is not accompanied by a higher level of compliance or better group performance. Contrary to Homans's cohesion-compliance hypothesis, Flache and Macy (1996) concluded that "peer pressure can be an effective instrument for blocking compliance, especially in groups in which the cost of compliance is high relative to the value of approval" (p. 29). Oliver (1980) describes this phenomenon, where social control is directed toward the maintenance of interpersonal relationships at the expense of compliance with group obligations, as the "second-order free-rider problem."

Exchange and Dependency Theories

Extensive research has been conducted that seeks to explain the emergence of networks based on exchange and dependency mechanisms. Social exchange theory, originally developed by Homans (1950, 1974) and Blau (1964), seeks to explain human action by a calculus of exchange of material or information resources. In its original formulation, social exchange theory attempted to explain the likelihood of a dyadic relationship based on the supply and demand of resources that each member of the dyad had to offer. Emerson (1962, 1972a, 1972b) extended this original formulation beyond the dyad, arguing that to examine the potential of exchange and power-dependence relationships, it was critical to examine the larger network within which the dyad was embedded. Since then, several scholars have developed this perspective into what is now commonly referred to as network exchange theory (Bienenstock & Bonacich, 1992, 1997; Cook, 1977, 1982; Cook & Whitmeyer, 1992; Cook & Yamagishi, 1992; Markovsky, Willer, & Patton, 1988; Skvoretz & Willer, 1993; Willer & Skvoretz, 1997; Yamagishi, Gillmore, & Cook, 1988).

Network exchange theory posits that individuals' power to bargain is a function of the extent to which they are vulnerable to exclusion from communication and other exchanges within the network. The argument is that individuals forge network links on the basis of their analysis of the relative costs and returns on investments. Likewise, individuals maintain links based on the frequency, the uncertainty, and the continuing investments to sustain the interaction. Location in the network may confer on some people an advantage over others in engaging in exchange relationships. Aldrich (1982) notes that this argument is at the core of several theories dealing with social exchange as well as resource dependency theories. Within organizations, network researchers have proposed a social exchange mechanism for the study of (a) power, (b) leadership, and (c) trust and ethical behavior. At the interorganizational level, researchers have (a) tested resource dependency theory, (b) examined the composition of corporate elites and interlocking board of directorates, and (c) sought to explain the creation, maintenance, and dissolution of interorganizational links. Each area is examined in greater detail below. The section concludes with proposed extensions to the study of organizational networks from a social exchange perspective.

Power

Social exchange theory has been used to examine the power that ensues from a structural position. In terms of exchange theory, power is defined as a function of dependence

others in the network. Location *in* the communication network is associated with greater power to the extent it offers greater access to valued material and informational resources. Specifically, people, groups, and organizations have power to the extent that they have access to alternate sources of a valued resource, and the extent to which they control resources valued by others in the network (Emerson, 1962). In a *series* of experimental and simulation studies, Cook and her colleagues (Cook & Emerson, 1978; Cook, Emerson, Gillmore, & Yamagishi, 1983) found evidence to support a power-dependence relationship. Carroll and Teo (1996) found that to increase their resources, organizational managers were more motivated than nonmanagers to have larger core discussion networks and to create more communication links outside the organization by memberships in clubs and societies. In her study of interorganizational social services, Alter (1990) found that the existence of a centralized, dominant core agency reduced the level of conflict and competition between service organizations and improved their level of cooperation. However, Hoffman, Stearns, and Shrader (1990) found that organizational centrality in four multiplex interorganizational networks depended on the nature of the network.

Several studies have equated network centrality with different sources of power. Brass (1984) suggested two measures of centrality that reflect different dimensions of power. Closeness, the extent to which people, groups, and organizations can reach all others in a network through a minimum of intermediaries, corresponds to the "access of resources" dimension of power (Sabidussi, 1966). Betweenness, the extent to which a network member lies between others not directly connected, corresponds to the "control of resources" dimension of power (Freeman, 1977, 1979). Brass (1954, 1985b) showed that both measures of centrality correlated with reputational measures of power. Further, Brass (1983, 1985b) found that employees with high scores on network indicators of power were more likely to be promoted to supervisory positions, and Burkhardt and Brass (1990) discovered that early adopters of a new technology increased their power. Ibarra (1993a) found that centrality in the informal network was at least as important as the formal hierarchical network in predicting power; Krackhardt (1990) reported similar results for advice and friendship networks. Interestingly, Brass and Burkhardt's (1992) research revealed that measures of centrality at the departmental level were more strongly related to several indexes of power than measures at the subunit or the organizational levels.

Leadership

The success of network formulations to predict power has prompted some scholars to suggest its use in extending theories of leadership such as Graen's (1976) leader-member exchange theory (Krackhardt & Brass, 1994) and attribution theories of leadership (McElroy & Shrader, 1986). Fernandez (1991) found that the effects of informal communication networks on perceptions of leadership were different in three types of organizations. Specifically, he found that informal communication predicted perceptions of leadership most strongly in the participatory organization, a telephone-counseling center; only weakly in the professional organization, a public finance department of a large investment bank; and not at all in the hierarchical organization, a metallurgical firm.

Trust and Ethical Behavior

Researchers have also used social exchange theory to study the development and utility of trust in organizational and interorganizational networks. As Burt and Knez (1996) note, "Trust is committing to an exchange before you know how the other person will reciprocate" (p. 69). In a study of managers in a large high-technology firm, they found that the communication networks in which two individuals were embedded pre-

dicted the probability of a trust relationship between them. In particular, the trust between two individuals in close contact was high if other members in the organizations indirectly connected the two members to one another. Further, the distrust between two individuals who were not in close contact was further attenuated if other members in the organization indirectly connected them to one another. This research indicates that indirect communication linkages reinforce trust and distrust relations between people. Labianca, Brass, and Gray (1998) also reported a similar amplification effect. They suggest that the amplification effect occurs because the secondhand information transmitted by indirect communication linkages "may be more polarized or exaggerated (either positively or negatively) than firsthand information" (p. 64), as grapevine (rumor) studies have found (e.g., DeFleur & Cronin, 1991; Schachter & Burdick, 19.55).

In a study involving trust as measured via friendship networks, Krackhardt and Stern (1988) found that a relatively higher proportion of interunit (as compared to intraunit) friendship ties was particularly helpful to organizations coping with crisis conditions. In this case, the high level of trust was seen as a prerequisite for the increased interunit coordination required during a period of high uncertainty and the ensuing potential conflict. Larson's (1992) study of entrepreneurial firms indicated that trust as well as shared reciprocity norms, close personal relations, and reputation determined with whom and how exchanges occurred.

Researchers examining ethical behavior in organizations also deploy the exchange mechanism. Brass, Butterfield, and Skaggs (1995) suggest that networks could also offer an explanation for the likelihood of unethical behavior in a dyad since the connectedness of people is highly related to their observability. Brass et al. (1995) propose that "the strength of the relationship between two actors will be positively related to the opportunity to act in an unethical manner, but negatively related to the motivation to act unethically. Frequency and trust provide increased opportunity, but intimacy and empathy decrease the motivation" (p. 6).

Resource Dependency Theory and Power in Interorganizational Networks

In his now classic article, Benson (1975) defined interorganizational networks as a political economy. By this he meant that interorganizational communication and exchange networks were the mechanisms by which organizations acquired and dispensed scarce resources, thus creating and perpetuating a system of power relations. Organizations were viewed as dependent on their positions in the network, which subsequently influenced their ability to control the flow of scarce resources.

Pfeffer and Salancik (1978) drew on Benson's work on political economy and social exchange mechanisms (Emerson, 1962, 1972a, 1972b) to formulate resource dependency theory. This theory argues that organizations structure their resource linkages to buffer themselves from the organization's environment (Pfeffer & Salancik, 1978). In particular, they identify two mechanisms that organizations can use toward this end. First, by network extension, organizations can seek to increase the number of exchange alternatives by creating new network links. Second, by network consolidation, they can decrease the number of exchange alternatives for others by forming a coalition with other resource providers. These counterbalancing mechanisms provide an explanation for the stability of exchange relationships and potential redistribution of power among the individuals. Burt (199 1) developed a measure of equilibrium to assess the likelihood that network members have the resources to reconfigure their exchange networks and therebv the distribution of power.

A major tenet of resource dependency theory is that organizations tend to avoid interorganizational linkages that limit their decision making and other forms of auton-

my Oliver (1991; see also Oliver, 1990) tested this assumption across five relational types that ranged from highest to lowest levels of autonomy: personal meetings, resource transfers, board interlocks, joint programs, and written contracts. Surprisingly, she found no evidence that linkages that implied greater loss of autonomy led to lower likelihood of establishing the relationship.

A substantial body of empirical research draws on a resource dependency framework to study the pattern of interorganizational networks. These studies examine a wide variety of resource relationships, including money, material, information, and messages. However, the focus of these relationships is more concerned with the pattern of relationships than their content; thus, the majority of resource dependency research is conducted from a positional perspective. In some of the earlier studies in this area, Laumann and Pappi (1976) and Galaskiewicz (1979) reported that organizations that were more central in their networks had greater reputational influence. In a broad-based study assessing the power of the U.S. labor force, Wallace, Griffin, and Rubin (1989) discovered that the labor force in industries that were more central in the network of interindustry transactions were more likely to receive higher wages than the labor force in peripheral industries. Gerlach's (1992) study of the Japanese corporate network, including intercorporate *keiretsu* groupings, found strong evidence of the centrality of financial institutions in these networks and their resultant ability to control the capital allocation process (see also Lincoln, Gerlach, & Takahashi, 1992). However, in a study of health systems, Oliver and Montgomery (1996) observed that "the organization with greatest influence within the system (because of its ability to allocate funds) may not be the organization that takes the largest role in terms of coordinating routine contacts" (p. 771), such as client referrals.

Two studies show the impact of resource exchange on effectiveness. Miner, Amburgey, and Stearns's (1990) research on 1,011 newspaper publishers in Finland from 1771 to 1963 found that publishers with a greater number of interorganizational resource linkages, typically to political parties, had a higher overall success rate. Goes and Park (1997) found that "a greater volume of [resource] exchanges between hospitals increases the likelihood that innovation will spread between them" (p. 771).

Provan and Milward (1995) reported research designed to extend resource dependency theory by focusing on the effectiveness of the entire interorganizational network (see also Provan, 1983) rather than the antecedents and outcomes of individual organizations. Further, they pointed out that how well individual organizations perform is less important than how the interorganizational network as a whole performs. Studying the mental health care delivery system in four cities, they found that networks with a centralized decision-making agency were more effective than networks in which decision making was widely dispersed across agencies. Their data also suggested that the relationship between network structure and network effectiveness is influenced by the existence of a relatively munificent environment and the degree to which the overall network is stable.

Corporate Elites and Interlocking Boards of Directors

Corporate elites and networks created by linkages among people who serve on multiple corporate boards are areas that have received considerable research attention in interorganizational relations. As Knoke (1993) indicated, "'A power elite is established at the intersection of three social formations: a class-conscious upper social class of wealth-holders, interlocked directors of major corporations, and a policy-planning network of foundations, research institutes, and nonpartisan organizations" (p. 26). Useem's (1984) classic study argued that these overlapping networks of friendship, ownership, membership, and directorship produced a core set of individuals, or "inner circle," which wields enormous power. Knoke (1993) explained that "because

its members simultaneously hold multiple directorships, the core can act politically in the interests of the class, which transcend the parochial concerns of its individual firms" (p. 26). Consistent with this view, Romo and Anheier (1996) found evidence that a core group of elites explained the emergence and institutionalization of consortia for private development organizations in Nigeria and Senegal. Studies have also shown that individuals who were more centrally located in the interlocking board of directors were also more likely to play a leadership role in cultural, philanthropic, and policy-making organizations (Domhoff, 1983; Mizruchi & Galaskiewicz, 1993; Ogliastri & Davila, 1987; Ratcliff, Gallagher, & Ratcliff, 1979; Useem, 1980).

Historically, the focus of interlocking directorate research has been on corporate control. However, Minz and Schwartz (1985) argued that "the most compelling interpretation of the overall network created by the collection of individual reasons for and response to director recruitment is a general communication system" (p. 141). In fact, as Mizruchi (1996) contends, "the emphasis on interlocks has moved increasingly toward their value as a communication mechanism rather than as a mechanism of control" (p. 284).

Creation, Maintenance, Dissolution, and Reconstitution of Interfirm Links

Studies have also deployed a resource dependency framework to explain the creation of links in interorganizational networks. Mizruchi and Stearns (1988) found two general factors that explained the addition of new financial members to an organization's board of directors. Under favorable economic conditions, when capital demand and supply are increasing, organizations initiate links with financial institutions through their board of directors to co-opt these institutions' financial and informational resources. However, during unfavorable economic conditions, including contractions in the business cycle, lower solvency, and lower profitability, it is the financial institutions that infiltrate companies' boards of directors to protect their investments. This finding is qualified by Boyd's (1990) research that showed high-performing firms responded to resource scarcity and competitive uncertainty by decreasing the number of their directors but increasing the density of their linkages with other firms. Mizruchi (1996) argued that a number of other factors also affect the creation of interlocking directorates. These include creating legitimacy for the firm, advancing the careers of those who serve as directors, and fostering the social cohesion of the corporate upper class.

Palmer et al. (1986) used resource dependency theory to hypothesize the conditions under which a broken interlock tie between two organizations (due to death, retirement, etc.) would be reconstituted. They found that interlock ties were likely to be reconstituted if the departing member represented an organization with which the focal organization had (a) formal coordination, such as long-term contracts or joint ventures; (b) direct business ties; or (c) headquarters that were physically proximate.

Larson (1992) demonstrated that firms tend to enter repeated alliances with each other; thus, dependencies tend to generate further dependencies. Gulati's (1995) research showed that the information provided by both direct and indirect ties of prior alliances established the basis for the formation of additional alliances. However, his research also showed that as the benefits of linking with specific others declined over time organizations looked for new alliances. Of course, as Baum and Oliver (1992) noted, there is a carrying capacity to alliances in that most organizations can successfully support only a limited number of connections, and many firms fear the overdependence that too many ties might bring.

Seabright, Levinthal, and Fichman (1992) theorized that reductions in the resource fit between organizations would lead to pressures to dissolve interorganizational relations

while increases in personal and structural attachments would counter those pressures and lead to continued relations. Their results supported the hypotheses but also showed that personal and structural attachments attenuated the firms' likelihood of dissolving ties under conditions of reduced fit. This finding underscores the importance of established communication and social attachments in maintaining interorganizational relations beyond the point where a strict exchange or resource dependency perspective would predict that they would dissolve, even at times when it might be disadvantageous to maintain them. Overall, however, Mizruchi's (1996) review of the research literature on corporate interlocks led him to conclude that "although the findings have been mixed, on balance they support the view that interlocks are associated with interfirm resource dependence" (p. 274).

The research on interlocking directorates assumes that each organization is a separate entity tied together at the top by corporate elites. While interest continues in interlocking directorates, a new field of research has developed over the past decade that focuses on an emergent organizational form, network organizations. This perspective relaxes these two assumptions of separate entities and executive ties only. We explore this new area in the next section.

Network Organizations

Network organizations are composed of a collection of organizations along with the linkages that tie them to each other, often organized around a focal organization. There are numerous variations on the network organizational form including joint partnerships, strategic alliances, cartels, R&D consortia, and a host of others.

The theoretical mechanisms that generate most network organizations are exchange and dependency relations. Rather than being organized around market or hierarchical principles, network organizations are created out of complex webs of exchange and dependency relations among multiple organizations. In a sense, the network organization becomes a supraorganization whose primary function is linking many organizations together and coordinating their activities. Unlike interlocking directorates, the network ties usually occur throughout the entire organization rather than only at the top, and the separate organizations often give up some or all of their individual autonomy to become a part of the new network organization.

Miles and Snow (1992) observe that network organizations differ from their predecessors (functional, multidivisional, and matrix forms) in four important ways. First, rather than subsume all aspects of production within a single hierarchical organization they attempt to create a set of relations and communication networks among several firms, each of which contributes to the value of the product or service. Second, networks are based on a combination of market mechanisms and informal communication relations. As they say, "The various components of the network recognize their interdependence and are willing to share information, cooperate with each other, and customize their product or service-all to maintain their position within the network" (p. 55). Third, members of networks are often assumed to take a proactive role in improving the final product or service, rather than merely fulfilling contractual obligations. Finally, a number of industries are beginning to form network organizations along the lines of the Japanese keiretsu, which links together producers, suppliers, and financial institutions into fairly stable patterns of relations

Poole (in press) argues that new organizational forms, including network organizations, are constituted out of six essential qualities:

1. The use of information technology to integrate across organizational functions
2. Flexible, modular organizational structures that can be readily reconfigured as new projects, demands, or problems arise
3. Use of information technology to coordinate geographically dispersed units and members

4. Team-based work organization, which emphasizes autonomy and self-management
5. Relatively flat hierarchies and reliance on horizontal coordination among units and personnel
6. Use of intra- and interorganizational markets to mediate transactions such as the assignment and hiring of personnel for projects and the formation of interorganizational networks.

In today's world, nearly all organizations are embedded to some extent in an emergent interorganizational communication network. For example, most economic institutions are linked together in "value chains" (Porter, 1980) or "value constellations" (Norman & Ramirez, 1993) where each receives a partially finished product from an "upstream organization," adds its contribution, and then delivers it to the next "downstream organization" for its contribution. Similarly, educational institutions typically relate to other educational institutions in a chain from preschool to postgraduate education. And religious organizations are frequently affiliated with coalitions of other like-minded religious groups. Of course, all must deal with the taxation authorities of federal, state, and local governments.

In one sense, network organizations create what have come to be called "boundaryless organizations" (Nohria & Berkley, 1991). Where one organization begins and the other ends is no longer clear. Organizations come to share knowledge, goals, resources, personnel, and finances, usually with highly sophisticated communication technology (Monge & Fulk, 1999). To accomplish this they must establish collaborative work arrangements, since that is the only way to transfer embedded knowledge.

Ghoshal and Bartlett (1990) argued that multinational corporations (MNCs) have traditionally been viewed as an intraorganizational network, in many ways not different from traditional national companies. Each satellite, subsidiary, or foreign partner has been seen as directly connected to the home corporate office, thus tying the MNC into an integrated hub-and-spoke structural whole. However, they point out that this view of the MNC fails to take into account the extended networks in which each of the subsidiaries is embedded. These national, regional, and competing global networks require a reconceptualization of MNCs as network organizations.

Limitations of Network Organizations

Several authors have pointed out that network organizations have a number of limitations. Miles and Snow (1992) observe that network organizations contain the vestigial weaknesses of their predecessors, the functional, multidivisional, and matrix forms. To the extent that parts of these prior forms remain in the network organization, the new form retains their prior limitations. Krackhardt (1994) identifies four potential constraints on communication and other networks. The first he calls the "law of N-squared," which simply notes that the number of potential links in a network organization increases geometrically with the number of people. In fact, it grows so quickly that the number of people to which each person could be linked quickly exceeds everyone's communication capacity. The second constraint is the "law of propinquity." a rather consistent empirical finding that "the probability of two people communicating is inversely proportional to the distance between them" (p. 213). Though numerous communication technologies have been designed to overcome this phenomenon, Krackhardt argues that the tendency remains and is difficult for people to overcome. The third constraint he identifies is the "iron law of oligarchy," which is the tendency for groups and social systems, even fervently democratic ones, to end up under the control of a few people. Finally, Krackhardt (1994) notes the potential problem of over-

embeddedness. He observes that "people as a matter of habit and preference are likely to seek out their old standbys, the people they have grown to trust, the people they always go to and depend on, to deal with new problems, even though they may not be the ones best able to address these problems" (p. 220).

Poole (in press) also points to several huge problems that stem from the tightly coupled technology but fluid management philosophies on which most network organizations are built. Foremost among these are maintaining a sense of mission, commitment, loyalty, and trust, and dealing with increased levels of work stress and burnout.

Extensions to Exchange and Dependency Theories

While some variation exists across different studies, the preponderance of evidence suggests that many inter- and intraorganizational communication networks are created and maintained on the basis of exchange mechanisms. Further, as people and organizations find their exchanges no longer rewarding or as new or competitive others offer better bargains in the exchange, linkages begin to dissolve.

Despite its intellectual roots in the study of interpersonal relationships, exchange and dependency theories have been more extensively deployed in the study of interorganizational networks, often within the context of resource dependency theory, rather than intraorganizational networks. Much of the intraorganizational research reviewed above, while premised in a social exchange perspective, does not invoke the theory explicitly. Further, in areas such as leadership, trust, and ethical behavior, the studies so far are more illustrative then programmatic attempts at applying social exchange theory. X-Net, a computer simulation tool developed by Markovsky (1995), should help researchers explore the emergence of networks in terms of different rules of exchange and varied resources. Researchers have also proposed integrating network exchange theory with rational choice theory (Markovsky, 1997) and identity theory (Burke, 1997), and a general theoretical method called E-state structuralism (Skvoretz & Fararo, 1996; Skvoretz & Faust, 1996), which integrates research on expectation states theory (Berger, Cohen, & Zelditch, 1966) with network exchange theory. Expectation states theory argues that a person's "behavior towards social objects depends on postulated and unobservable states of relational orientations to objects, E-states for short" (Skvoretz & Fararo, 1996, p. 1370). The social objects toward which individuals orient are the networks of ties among the individuals. E-state models specify "how the state of this network, i.e., the number and nature of the ties linking actors, changes over time as individuals interact" (Skvoretz & Fararo, 1996, p. 1370).

Contagion Theories

Contagion theories are based on the assumption that communication networks in organizations serve as a mechanism that exposes people, groups, and organizations to information, attitudinal messages, and the behavior of others (Burt, 1980, 1987; Contractor & Eisenberg, 1990). This exposure increases the likelihood that network members will develop beliefs, assumptions, and attitudes that are similar to those of others in their network (Carley, 1991; Carley & Kaufer, 1993). The contagion approach seeks to explain organizational members' knowledge, attitudes, and behavior *on* the basis of information, attitudes, and behavior of others in the network to whom they are linked. Rogers and Kincaid (198 1) refers to this as the *convergence* model of communication.

Theories that are premised on a contagion model, at least in part, include social information processing theory (Fulk, Steinfield, Schmitz, & Power, 1987; Salancik & Pfeffer, 1978), social influence theory (Fulk, Schmitz, & Steinfield, 1990; see also Marsden &

Friedkin, 1994), structural theory of action (Burt, 1982), symbolic interactionist perspectives (Trevino, Lengel, & Daft, 1987), mimetic processes exemplified by institutional theories (DiMaggio & Powell, 1983; Meyer & Rowan, 1977), and social cognitive theory (Bandura, 1986). Fulk (1993) notes that these constructivist perspectives "share the core proposition that social and symbolic processes produce patterns of shared cognitions and behaviors that arise from forces well beyond the demands of the straightforward task of information processing in organizations" (p. 924). She also points out that the mechanisms offered by these theories differ not so much because of conflicting premises as because the theories focus on different aspects of the social construction process.

The contagion mechanism has been used to explain network members' attitudes as well as behavior. Erickson (1988) offers a comprehensive overview of the various theories that address the "relational basis of attitudes" (p. 99). She describes how various network dyadic measures such as frequency, multiplexity, strength, and asymmetry can shape the extent to which others influence individuals in their networks. Moving beyond the dyadic level of network contagion, she also describes cohesion and structural equivalence models that offer alternative, and in some cases complementary, explanations of the contagion process. Contagion by cohesion implies that the attitudes and behaviors of the others with whom they are directly connected influence network members. Contagion by structural equivalence implies that others who have similar structural patterns of relationships within the network influence people.

An impressive body of empirical research at both the intraorganizational and interorganizational levels is based on the contagion mechanism. At the intraorganizational level, studies have proposed a contagion mechanism to explain (a) general workplace attitudes, (b) attitudes toward technologies, and (c) organizational behavior such as turnover and absenteeism. Researchers have also used contagion to explain interorganizational behavior. Each of these topics is reviewed on the following pages. The section concludes with suggestions for extensions of organizational research based on a contagion mechanism.

General Workplace Attitudes

Several studies have examined the extent to which contagion explains individual attitudes in the workplace. Friedkin's (1984) early research showed that educational policy makers were more likely to perceive agreement with others who were either in the same cohesive social circle or were structurally equivalent. Walker (1985) discovered that members of a computer firm who were structurally equivalent were more likely to report similar cognitions about means-ends relationships of product development. And Rentsch (1990) found that members of an accounting fin-n who communicated with one another were more likely to share similar interpretations of organizational events.

Goodell, Brown, and Poole (1989) use a structurational argument (Poole & McPhee, 1983) to examine the relationship between communication network links and shared perceptions of organizational climate. Using four waves of observation over a ten-week period from an organizational simulation, they found that members' communication networks were significantly associated with shared perceptions of the organizational climate only at the early stages of organizing (weeks two and four). In another study comparing the cohesion and structural equivalence mechanisms of contagion, Hartman and Johnson (1989, 1990) found that members who were cohesively linked were more likely to have similar levels of commitment to the organization. However, those who were structurally equivalent were more likely to have similar perceptions of role ambiguity in the workplace. Pollock, Whitbred, and Contractor (1996) compared the relative efficacy of three models that seek to explain an individual's satisfaction in the workplace: the job characteristics

model (Hackman & Oldham, 1976), the individual dispositions model (Staw & Ross, 1985), and the social information processing model (Salancik & Pfeffer, 1978). Using data from the public works division of a military installation, Pollock et al. (1996) found that employees' satisfaction was significantly predicted only by the social information processing model, that is, by the satisfaction of friends and communication partners in their social networks, but not by the characteristics of their jobs or their individual dispositions.

Attitudes Toward Technologies

Several researchers have examined the extent to which contagion explains organizational members' attitudes toward technologies. Drawing on social information processing theory (Salancik & Pfeffer, 1978) and social cognitive theory (Bandura, 1986), Fulk and her colleagues (Fulk, Schmitz, & Ryu, 1995; Schmitz & Fulk, 1991) found that organizational members' perceptions and use of an electronic mail system were significantly influenced by the attitudes and use of the members' supervisors and five closest coworkers. Further, Fulk (1993) found that social influence was even more pronounced in more cohesive groups. The attitudes and use of other members in their communication networks significantly influenced individuals' attitudes and use of an electronic mail system. This effect was attenuated, but persisted, even after she controlled for the effect of the work group's attitudes and use on each group member.

Rice and Aydin's (1991) research showed that hospital employees who communicated with one another or shared supervisory-subordinate relationships were more likely to share similar attitudes about a recently introduced information technology. Rice et al. (1990) found that individuals' use of email in a decentralized federal agency was predicted by the use of the technology by others in their communication network. Further, groups of individuals who communicated more strongly with one another were more likely to share similar distinct email usage patterns.

Using longitudinal data from a federal government agency, Burkhardt (1994) found that individuals' attitudes and use of a recently implemented distributed data-processing computer network were significantly influenced by the attitudes and use of others in their communication network. She found that individuals' perceptions of their self-efficacy with (or mastery of) the new technology were significantly influenced by those with whom they had direct communication, which is the theoretical mechanism of contagion by cohesion. However, individuals' general attitudes and use of the technology itself were more influenced by the attitudes and behaviors of those with whom they shared similar communication patterns, that is, contagion by structural equivalence. Burkhardt also found that the contagion effect was higher for individuals who scored higher on a self-monitoring scale.

Extending this line of longitudinal research on contagion effects, Contractor, Seibold, and Heller (1996) conducted a study comparing the evolution of the social influence process in face-to-face and computer-augmented groups. They found that group members initial influence on each others' perceptions of the structures-in-use (i.e., the interaction norms enacted during the meeting) was high in the face-to-face condition, while group members using group decision support systems (GDSSs) started out with low levels of social influence on one another. However, the difference between face-to-face and technologically augmented groups was only transient. By their third meeting, members in all groups heavily influenced each other's perceptions of the structures-in-use. While the preponderance of research has focused on similarity in attitudes based on contagion, Bovasso (1995) reports results from a process he calls "anticontagion." In a study of managers at a large, multinational high-tech firm, Bovasso found that "individuals who perceive themselves as strong leaders are influenced by peers who do not perceive themselves as

strong leaders" (pp. 1430-1431) and vice versa.

Behavior Through Contagion

Several network studies have used a contagion explanation for organizational members' behaviors, including voluntary turnover, absenteeism, job-seeking, socialization, and unethical behavior. Krackhardt and Porter (1986) found that employees voluntarily quitting their jobs were more likely to be structurally equivalent to one another than those who remained. However, they found that employees who were absent were more likely to be cohesively connected with one another through friendship ties. They suggested that decisions about turnover were more closely related to individuals' roles in the organization and hence, members were more influenced by others in similar roles. On the other hand, decisions about absenteeism reflected norms in the organizations that were communicated through cohesive friendship ties. In a more recent study, Feeley and Barnett (1996) examined employee turnover at a supermarket and found that both social influence and structural equivalence networks predicted the likelihood of employees leaving the organization. Kilduff (1992) studied graduate business students' job-seeking behavior and found that students' decisions to interview with particular organizations were influenced by the opinions communicated to them by others in their friendship networks. The contagion effect was more pronounced for students who reported being high self-monitors. Zey-Ferrell and Ferrell (1982) reported that employees' self-reported unethical behavior was better predicted by their perceptions of their peer behavior than either their own beliefs or those of top management. Research on organizational socialization (Jablin & Krone, 1987; Sherman, Smith, & Mansfield, 1986) has also identified newcomers' positions in their new communication networks as a predictor of their assimilation into the organization.

Interorganizational Contagion

The contagion mechanism has also been used to explain behavior at the interorganizational level. Organizations can link to other organizations in many ways. Useem (1984) describes how organizations use director interlocks as a tool to scan their environment. These linkages are important because they provide the opportunity for communication and the exchange of ideas, practices, and values. Both the formal activities surrounding the board meetings and the informal activities and acquaintance ties that are created enable people to discover how things are done in other organizations. In these and similar interorganizational studies, the opportunity to communicate afforded by the existence of linkages is viewed as more important than specific message content.

Consistent with Useem's (1984) view, much of the more recent literature examines the mechanisms by which organizations use these linkages to transfer organizational practices and structural forms. Davis (199 1) found that *Fortune* 500 corporations were more likely to adopt the "poison pill" strategy to defend against corporate takeovers if their boards had directors from organizations that had already adopted a similar strategy. Haunschild's (1993) research showed that the number and types of corporate acquisitions undertaken by their interlock partners significantly influenced the number and type of takeovers attempted by firms. Likewise, her 1994 research demonstrated that "acquisition premiums" (p. 406), the price that a firm pays to acquire another firm over the market value prior to the takeover announcement, are similar to those that their partner firms paid for their acquisitions. Other research by Palmer, Jennings, and Zhou (1993) has shown that firms are more likely to adopt a multidivisional form when they are linked to corporations that have already adopted that form. Similarly, Burns and Wholey (1993) found that a hospital's decision to adopt a matrix management program was significantly pre-

directed by the adoption decision of other local hospitals with high prestige and visibility. Goes and Park (1997) found that hospitals that were structurally tied to other hospitals in a multihospital system were more likely to adopt innovations, and Westphal, Gulati, and Shortell (1997) found that contagion also explained the adoption of total quality management (TQM) practices in the organization. However, they observed that early adopters of TQM were more likely to use the other early adopters in their medical alliance network to clarify their functional understanding of TQM. The early adopters were therefore more likely to customize the program to their organizational needs. In contrast, late adopters were more likely to seek out other adopters in their alliance network to determine the legitimacy of using TQM. Hence, the late adopters were more likely to adopt the TQM program without any customization. Stearns and Mizruchi (1993) found that the type of financing used by a firm, short- versus long-term debt, was influenced by the types of financial institutions to which it was linked by its board of directors, commercial bankers versus representatives of insurance companies. However, the embeddedness of an organization's board of directors has a somewhat counterintuitive influence on the selection of its CEO. Khurana (1997) found that *Fortune* 500 companies whose boards of directors were well embedded into the system of interlocking directorates were less likely to choose an outsider as a CEO because "a high level of embeddedness is likely to constrain actions rather than facilitate them" (p. 17).

Interlocking directorates are only one of several possible mechanisms for linking organizations. Organizations are likely to be linked to bankers, attorneys, accountants, suppliers, and consultants, all of whom serve as conduits for the flow of information between organizations. Basing their arguments *on* the mimetic processes articulated by institutional theory (DiMaggio & Powell, 1983), Galaskiewicz and Burt (1991), and Galaskiewicz and Wasserman (1989) discovered that contribution officers who were structurally equivalent in an interorganizational corporate network were more likely to give charitable donations to the same nonprofit groups than those who were cohesively linked. Mizruchi (1989, 1992) found that organizations that were structurally equivalent in the interorganizational network were more likely to have similar patterns of political contributions. Baum and Oliver (1991) showed that increased ties to legitimating institutions significantly reduced the likelihood of failure among new organizations. And in a ten-year study, Goes and Park (1997) found that hospitals linked to their institutional environments through industry and trade associations were more likely to adopt innovations in an effort to gain legitimacy. This effect was even more pronounced when the hospital industry entered a turbulent phase after introduction of two regulatory events in 1983. Interestingly, these findings are similar to those obtained under predictions from exchange and resource dependency theories, though obviously generated by a different theoretical mechanism,

Extensions to Contagion Theories

Contagion theories offer by far the most common theoretical mechanisms for studying the emergence of networks. The notion of a network as labyrinth of conduits for information flow lends itself to theoretical mechanisms based on contagion. However, while network researchers frequently invoke contagion theories, they often fall short of articulating specific mechanisms and network models by which individuals, groups, and organizations influence each other's actions and behaviors (Contractor & Eisenberg, 1990; Marsden & Friedkin, 1993; Rice, 1993b). There are four recent attempts to articulate mechanisms that make the contagion process more theoretically specific and comprehensive for communication networks.

First, Krackhardt and Brass (1994) note that the contagion processes described by social information processing theory must over time lead to an equilibrium wherein everyone

in the network will eventually converge in their attitudes or actions. They note that this conclusion undermines the very premise of social information processing theory, which seeks to explain the variation in people's attitudes based on their differential exposure to social information. Krackhardt and Brass (1994) suggest that the *principle of interaction* that is assumed by contagion theories needs to be augmented by a second contagion mechanism, the *principle of reflected exclusivity*. The principle of interaction states that greater interaction leads to greater similarity in attitudes. By contrast, the principle of reflected exclusivity states that "the degree of influence person j has on person i's evaluation . . . is inversely proportional to the amount of time person j spends with all others" (Krackhardt & Brass, 1994, p. 219).

Second, Krassa (1988) advocates the inclusion of members' threshold levels in a social influence model. In its simplest form, the threshold is the number of others that people must be influenced by before succumbing (Granovetter, 1978). Individuals' thresholds could be a function of the intensity of their opinion and their aversion to the risk of being socially isolated. Krassa (1988) uses computer simulations of a contagion model to demonstrate the effects of people's threshold distributions on their opinions.

Third, Rice (1993b) has argued that a network contagion model of social influence should also take into consideration the ambiguity of the situation. Drawing on research by Moscovici (1976), Rice (1993b) argues that people are more vulnerable to social influence by contagion when confronted with ambiguous, or novel, situations. Based on this argument, Contractor and Grant (1996) hypothesized that groups using new collaboration technologies (a novel situation) would be more likely to influence each other's perceptions of the medium than groups in a traditional face-to-face meeting. However, they found that social influence was actually greater in face-to-face groups, perhaps because the novelty in this case was associated with the very medium used to socially influence one another.

Finally, in an attempt to extend the current debate surrounding the relative efficacy of contagion via cohesion versus structural equivalence, Pattison (1994) argued for a closer examination of automorphic or regular equivalence in addition to mechanisms based on contagion by cohesion and structural equivalence. Unlike structural equivalence, which in its strict operationalization is defined as two individuals having identical network links to the same others, regular equivalence is defined as two people having similar patterns of relationships, but not necessarily with the same others (White & Reitz, 1989). Pattison (1993) argues that people who are regularly equivalent are more likely to have similar social cognitions because "cognitive processes may directly involve the individual's perceptions of his or her social locale" (p. 93). In a longitudinal study of students in an undergraduate class, Michaelson and Contractor (1992) found that students who were regularly equivalent were more likely to be perceived as similar by their classmates than those who were structurally equivalent.

Cognitive Theories

The contagion mechanisms discussed in the previous section focused on the extent to which others who were linked to individuals via cohesion or structural equivalence influenced their attitudes and actions. These studies explain attitudes and behavior based on individuals' actual interactions. Researchers have employed four concepts to gain insight into the structure of individuals' cognitions: semantic networks, knowledge structures, cognitive social structures, and cognitive consistency. These areas are discussed in greater detail below.

Semantic Nehvorks

With an eye toward a more systematic treatment of message content, semantic net-

works were introduced into the organizational communication literature by Monge and Eisenberg (1987; see also Carley, 1986; Danowski's [1982] word network analysis; Dunn & Ginsberg, 1986; Fiol's [1989] semiotic analysis; Rogers & Kincaid's [1981] convergence theory of networks; Woelfel & Fink's [1980] Galileo system). The essential feature of this perspective was a focus on the shared meanings that people have for message content, particularly those messages that comprise important aspects of an organization's culture, such as corporate goals, slogans, myths, and stories. Monge and Eisenberg (1987) argued that asking people to provide their interpretations of one or more significant communication messages, events, or artifacts could create semantic networks. Content analysis of members' responses provides categories of interpretation. Linkages can then be created between people who share similar interpretations. The resultant network articulation provides a picture of the groups of people who share common understandings, those who have idiosyncratic meanings such as isolates, and those who serve as liaisons and boundary spanners between the various groups.

With respect to empirical studies of semantic networks Lievrouw, Rogers, Lowe, and Nadel (1987) used four methods to identify the invisible research colleges among biomedical scientists: (a) co-citation analysis, (b) coword occurrence, (c) interpretive thematic analysis, and (d) network analysis. They concluded that their focus on the content of the networks helped clarify the structure of the invisible colleges. On the basis of communication network patterns alone, all the scientists would have been clustered into one invisible college. However, a closer examination of content helped them identify several invisible colleges, "each of which represents a distinct and identifiable line of research" (p. 246).

In a study of a high-technology firm, a library, and a hospital, Contractor, Eisenberg, and Monge (1996) examined the semantic networks representing the extent to which employees shared interpretations of their organizations' missions. In addition to their actual agreement, employees were also asked to report their perceived agreement, that is, the extent to which they believed others shared their interpretations in the organization. They found that employees at higher levels in the hierarchy were more likely to perceive agreement, even in cases when there was no agreement. However, employees with more tenure in the organization were more likely to have actual agreement, even though they did not perceive that others shared their interpretations of the mission. Contrary to the accepted view that communication builds shared meaning, employees cohesively connected in the communication network were not more likely to agree with their colleagues' interpretations of the organizational mission, even though they perceived agreement. However, employees who were structurally equivalent were more likely to share actual agreement, even though they were not as likely to perceive agreement.

Krackhardt and Kilduff (1990) applied the notion of semantic networks to examine individuals' attributions about others in the network. They asked individuals in an organization to make cultural attributions on seven dimensions about the behaviors of each other member in the organization. They found that individuals who were friends were more likely than nonfriends to make similar attributions about other members in the organization. Rice and Danowski (1993) applied the notion of semantic networks to examine individuals' attributions of the appropriation of a voice mail system. They found that individuals who used the system for "voice processing" (i.e., routing and structuring the flow of messages among individuals) characterized their use of the technology in terms that were systematically distinct from those who used the voice mail technology as a substitute for traditional answering machines.

Two studies have used semantic networks to examine variations in national cultures. Jang and Barnett (1991) analyzed the chief

operating officer's letter that 17 Japanese and 18 U.S. organizations published in the organization's annual report to stockholders. They found that the co-occurrence of words in these messages resulted in two distinct clusters for the Japanese and U.S. companies. Further, the words co-occurring in the Japanese annual reports focused on concepts related to organizational operations, while the U.S. documents focused on concepts related to organizational structure. In a study of 12 managers from five European countries, Stohl (1993) examined the cultural variations associated with managers' interpretation of a key communicative process, worker participation. She found that the semantic network based on shared interpretations of the concept reflected greater connectedness within countries than between countries. Further, similarities in interpretations about worker participation were systematically associated with three of Hofstede's (1984) dimensions of cultural variability across countries. These were (a) the power distance index, the extent to which less powerful people accept inequality in power; (b) the uncertainty avoidance index, the extent to which people avoid uncertainty by relying on strict codes of behavior; and (c) individualism, the extent to which citizens place primary importance on the needs of the individual rather than the collective.

Extensions to semantic networks. The theoretical mechanisms of contagion have also been used to explain the co-evolution of communication and semantic networks. Contractor and Grant (1996) developed a computer simulation of the effects of social contagion in communication and semantic networks that contained varying levels of initial network density and heterogeneity. They found that the time required for semantic convergence within groups was positively related to the density of the communication and semantic networks, inversely related to the heterogeneity of the communication network, and inversely related to the individual's inertia against being influenced socially. Significantly, the initial heterogeneity in the semantic network, an indicator of initial variation in interpretations, was not a Significant predictor of the time required for semantic convergence.

In a similar endeavor, Carley (1991) offered a "constructural" theory of group stability, modeling the parallel cultural and social evolution of a group. Social structure was defined as the distribution of interaction probabilities, and culture was defined as the distribution of distinct facts. Carley's (1991) model described a cycle of three events for each group member: "(1) action-exchange information with their partners; (2) adaptation-acquire the communicated information and update the probabilities of interaction; and then (3) motivation-choose new interaction partners on the basis of their new probabilities of interaction" (p. 336). Results of computer simulations showed that these groups did not evolve monotonically toward greater homogeneity. Instead they often oscillated through cycles of greater and lesser cohesiveness. Her simulations also indicated that groups with "simpler" cultures (i.e., fewer facts to be learned by group members) tended to stabilize more quickly. Further, those in less homogeneous groups (i.e., where facts were not equally distributed) were less likely to stabilize, since they could form enduring subcultures. One corollary of constructural theory is that the probabilities for two individuals to interact are not symmetric (Carley & Krackhardt, 1996).

Network Organizations as Knowledge Structures

A complementary view of semantic networks as meaning structures is provided by Kogut, Shan, and Walker (1993), who argued that it is interesting to view interorganizational networks as structures of knowledge. Organizations seek out other organizations because they want to establish some form of relationship. But to do so, they must first find at least some of the other organizations that are also interested in entering into the relationship with them and choose among the al-

ternatives. This means they must acquire information about the other organization and compare it with information from other organizations. Often, in searching for partners, organizations begin close to home or on the basis of recommendations from others with whom they are already linked. Over time, this searching process builds up a knowledge base about the skills, competencies, trustworthiness, and other capabilities of the organizations.

Once organizations choose partners, however, they tend to spend less time seeking other partners. As Kogut et al. (1993) say, "Because information is determined by previous relations and in turn influences the subsequent propensity to do more relations, the structure of the network tends to replicate itself over time. The early history of cooperation tends to lock in subsequent cooperation" (p. 70). Further. they observe:

> The replication of the network is a statement of the tendency of learning to decline with time. The structure of the network is a limiting constraint on how much new learning can be achieved. . . . But when viewed from the perspective of the evolution of networks, there is a tendency for old lessons to be retaught. (p. 71)

Powell, Koput, and Smith-Doerr (1996) argue that learning networks are particularly important in industries where there is rapid technological development, knowledge is complex, and expertise is distributed around many organizations. Using data collected on 225 firms over four years, they found strong evidence for increasing levels of interorganizational communication and collaboration in the biotechnology industry, including increases in ties and network density. In a study of two new biotechnology firms (NBFs), Liebeskind, Oliver, Zucker, and Brewer (1996, p. 428) documented how they used social networks to "source their most critical input-scientific knowledge." They found that "almost none of the individual-level exchanges of knowledge through research collaboration involved organizations with which either NBF had a market agreement" (p. 439). The lack of market-based contractual arrangements increased their flexibility to create and dissolve networks as well as adapt strategically to evolving research interests.

Bovasso (1992) used four network measures of an organization's structure-density, range, prominence, and elitism-to examine the changes that resulted when three high-technology, knowledge-intensive firms on three continents were merged by the parent corporation to create a single networked organization. In the newly formed networked organization, Bovasso found support for the emergence of a structural convergence, with geographic divisions and hierarchical levels having a smaller impact on members' involvement in the influence of ideas and control of resources. More specifically, geographical and hierarchical differences in prominence, elitism, and density scores between middle and upper management in the three firms were reduced.

Cognitive Social Structures

Several researchers (Corman & Scott, 1994; Krackhardt, 1987) have sought to distinguish people's cognitions of social structures from their actual, observed communication networks. This line of research was precipitated by a series of studies in the early 1980s questioning the ability of informants to accurately report their own communication network patterns (Bernard, Killworth, & Sailer, 1980, 1982; Bernard, Killworth, & Cronenfeld, 1984; Freeman, Romney, & Freeman, 1987). Their results underscored the problematic nature of collecting self-report measures of communication network data if the underlying theory being tested was based on the assumption that individuals' attitudes and behavior were shaped by their actual communication networks. However, as Richards (1985) argued, the differences between self-reported and observed network data are problematic only if the underlying theoretical construct being measured was actual commu-

nication behavior (see also Marsden, 1990). In fact, Richards (1985) notes, many social and psychological theories are based on individuals' perceptions-an assertion well captured by W. I. Thomas's observation that "perceptions are real in their consequences even if they do not map one-to-one onto observed behaviors" (Krackhardt, 1987, p. 128; Pattison, 1994). For researchers drawing on such social and psychological theories, a discrepancy between observed and self-reported measures would suggest a measurement error in using data about observed communication.

Krackhardt (1987) developed the concept of cognitive social structures to characterize individuals' perceptions of the social networks. Cognitive social structures assume the status of socially shared, structural "taken-for-granted facts" (Barley, 1990, p. 67) by individuals about the predictable and recurrent interactions among individuals in the network, even if these cognitions are at variance with the actual communication. Krackhardt (1987) aggregated individuals' cognitive social structures to estimate a "consensual" cognitive social structure, in which a link existed between two individuals if others in the network perceived this tie, irrespective of whether it was acknowledged by either of the people in the dyad. As such, a link in the "consensual" cognitive social structure indexed a common adage: It is not who you know, but who others think you know.

Several empirical studies have demonstrated the explanatory power of the cognitive social structure concept. Krackhardt (1987) found that managers in a high-technology entrepreneurial firm who were deemed as highly central (betweenness) in the consensual cognitive social structure were significantly more likely to be able to reconstruct the "actual" advice network reported by the people involved. Krackhardt (1990) also found that the perceived influence of organizational members was significantly associated with their ability to accurately estimate the consensual cognitive social structure in terms of advice relationships. Krackhardt's (1992) research chronicled how a union's inability to accurately assess the organization's social structure led to its failure in organizing employees. Further, Kilduff and Krackhardt (1994) demonstrated that individuals' reputations in the organization were more closely associated with their centrality in the consensual cognitive structure than in the "actual" communication network based on the self-reports of the people involved. Finally, Heald, Contractor, Koehly, and Wasserman (1996) found that individuals of the same gender, in the same department, and in a supervisor-subordinate relationship were more likely to share similar cognitive social structures. Those individuals who were linked in acquaintance and communication networks were also more likely to share similar cognitive social structures.

Extensions to cognitive social structures. The conceptual and empirical work on cognitive social structures has moved the initial debate about differences between actual and perceived communication from the methodological and measurement domain to a substantive exploration of the ways in which actual and perceived communication enable and constrain each other. Corman and Scott (1994) deployed Giddens's (1984) structuration theory to argue that three modalities explain the recursive relationships between observable communication and cognitive social structures: reticulation, activation, and enactment. Reticulation denotes the duality in which perceived communication relationships are produced and reproduced in observable communication behavior. Activation represents the duality of activity foci in the structural domain with joint activity in the interaction domain. Enactment relates coding conventions in the structural domain to triggering events in the interaction domain (Corman, 1997, p. 69). They refer to this perspective as the latent network of perceived communication relationships.

Research on cognitive social structures has taken on additional currency with the advent of virtual organizations, supported by information and communication technologies. In traditional organizations, individuals who are

physically co-located have several opportunities to observe face-to-face interactions, and thereby shape their perceptions and social cognitions (Brewer, 1995) of the organization's social structures. The pervasiveness of electronic communication media in virtual organizations makes it increasingly difficult for individuals to discern social structures. Consequently, organizational members have significant problems accurately determining "Who knows who?" and "Who knows who knows who?" Information technologies that are responsible for triggering this problem can also be used to overcome these obstacles. Because information transacted over electronic media such as the Web can be stored in digital form, a new generation of software called "collaborative filters" has emerged (Contractor, 1997; Contractor, O'Keefe, & Jones, 1997; Contractor, Zink, & Chan, 1998; Kautz, Selman, & Shah, 1997; Nishida, Takeda, Iwazume, Maeda, & Takaai, 1998). These filters can be used to make visible the organization's virtual social and knowledge structures. Collaborative filters process individuals' interests, relationships, and the structure and content of their electronically stored information (such as Web pages). They can assist individuals in searching the organization's databases to automatically answer questions about the organization's knowledge network, that is, "Who knows what?" as well as questions about the organization's cognitive knowledge networks, that is, 'Who knows who knows what?' within the organization. The use of these kinds of tools is likely to have a leveling effect on the organization's cognitive social structure, because they can potentially undermine the perceived centrality of those individuals in the organization who are viewed as important resources about the organization's social and knowledge networks.

Cognitive Consistency

Like the semantic networks and cognitive Social structures discussed above, consistency theories focus on members' cognitions. However, in this case the explanatory mechanism underscores individuals' aspirations for consistency in their cognitions. When applied to organizational communication networks, consistency theories seek to explain the extent to which a drive for consistency is manifest in people's networks and attitudes. That is, members' attitudes are viewed as a function of the balance in their networks rather than alternative mechanisms such as contagion. Heider's (1958) balance theory posited that if two individuals were friends, they should have similar evaluations of an object. This model was extended and mathematically formulated by Harary, Norman, and Cartwright (1965), and later by Davis and Leinhardt (1972), and Holland and Leinhardt (1975), who argued that the object could be a third person in a communication network. If the two individuals did not consistently evaluate the third person, they would experience a state of discomfort and would strive to reduce this cognitive inconsistency by altering their evaluations of either the third person or their own friendship. They extended this line of argument to all possible triads in a network. Researchers have examined the effects of cognitive consistency on both attitudes and behavior.

The effect of cognitive consistency on attitudes. Consistency theories have played an important role in clarifying an earlier debate about the relationship between involvement in communication networks and work attitudes such as job satisfaction and organizational commitment. Early studies (e.g., Brass, 1981; Eisenberg, Monge, & Miller, 1984; Roberts & O'Reilly, 1979) reported contradictory and inconsistent findings about the extent to which individuals who were well connected, integrated, or central in their communication networks were more likely to be satisfied and committed to their organizations. Consistency theories suggest that it is not the centrality or number of links in individuals' networks but the perceived balance within the network that influences level of satisfaction and commitment. Krackhardt and Kilduff (1990) found that individuals' job satisfaction scores were predicted by the

extent to which they agreed with their friends on cultural attributions about other members in the network. Kilduff and Krackhardt (1993) found that individuals who were highly central in the friendship network were less satisfied than others who were less central; however, those who saw their friendship networks in balance (they call it "schema consistent") were more likely to be satisfied and committed. In a study of three organizations (described earlier in the Semantic Networks section), Contractor, Eisenberg, and Monge (1996) also found that the extent to which employees shared common interpretations of their organization's mission had no direct bearing on their level of satisfaction or organizational commitment. However, those who perceived greater agreement with others' interpretations were more likely to be satisfied and committed. Barnett and Jang (1994), while not explicitly invoking consistency theories, found that members of a police organization who were central and connected in their communication networks were more likely to perceive their views of salient organizational concepts as being consistent with those of others. Researchers have used network concepts of transitivity to operationalize the effect of balance in the network.

The effect of cognitive consistency on behavior. Consistency theories have also been related to the behavior of organizational members. Krackhardt and Porter (1985) found that friends of those who voluntarily left an organization were no longer exposed to their former coworkers' unhappiness and were therefore able to restore their previous perceived balance; as a result they reported greater levels of satisfaction following the departure of these friends from the organization. Brass et al. (1995) argued that the need for balance among three people can also influence the likelihood of unethical behavior. "The addition of the third party with strong ties to both other actors will act as a major constraint on unethical behavior when the two actors are only weakly connected" (p. 7). Further, they proposed that the likelihood of unethical behavior is least likely to occur when all three people are connected by strong ties (i.e., a Simmelian triad; Krackhardt, 1992).

Extensions to cognitive consistency theories. The deployment of consistency theories to explain organizational phenomena is relatively recent. Conceptually and analytically, it challenges network researchers to move from the dyad to the triad as the smallest unit of analysis. As the examples above indicate, it has the potential of resolving many of the inconsistent results in network studies that use the dyad as the primary unit of analysis,

Like the other cognitive theories discussed in the previous section, consistency theories have also been used to address the ongoing debate about differences between actual and perceived communication. Freeman (1992) suggested that consistency theories offer a systematic explanation for differences between actual and self-report data on communication. He argued that individuals' needs to perceive balance in observed communication networks help explain some of the errors they make in recalling communication patterns. Using experimental data collected by De Soto (1960), Freeman found that a large proportion of the errors in subjects' recall of networks could be attributed to their propensity to "correct" intransitivity, a network indicator of imbalance, in the observed network.

Theories of Homophily

Several researchers have attempted to explain communication networks on the basis of homophily, that is, the selection of others who are similar. Brass (1995b) notes that "similarity is thought to ease communication, increase predictability of behavior, and foster trust and reciprocity" (p. 51). Homophily has been studied on the basis of similarity in age, gender, education, prestige, social class, tenure, and occupation (Carley, 1991; Coleman, 1957; Ibarra, 1993b, 1995; Laumann, 1966; Marsden, 1988; McPherson & Smith-Lovin, 1987).

Several lines of reasoning support the homophily hypothesis. These fall into two general categories: the sitnilarity-attraction hypothesis (Byrne, 1971) and the theory of self-categorization (Turner, 1987). The similarity-attraction hypothesis is exemplified in the work of Heider (1958), who posited that homophily reduces the psychological discomfort that may arise from cognitive or emotional inconsistency. Similarly, Sherif (1958) suggested that individuals were more likely to select similar others because by doing so they reduce the potential areas of conflict in the relationship. The theory of self-categorization (Turner & Oakes, 1986) suggests that individuals define their social identity through a process of self-categorization during which they classify themselves and others using categories such as age, race, gender. Schachter (1959) argued that similarity provided individuals with a basis for legitimizing their own social identity. The manner in which individuals categorize themselves influences the extent to which they associate with others who are seen as falling into the same category.

A substantial body of organizational demography research is premised on a homophily mechanism. In addition, several studies have focused specifically on gender homophily. Each area is reviewed below.

Gerreral Demographic Homophily

The increased workforce diversity in contemporary organizations has seen a rise in the creation of heterogeneous work groups that complicate individuals' desires for homophily. Several studies have examined the extent to which individuals' predilection for homophily structures organizational networks. Zenger and Lawrence (1989) found that technical communication among researchers in a high-technology firm was related to their age and tenure distribution. Studies by O'Reilly and colleagues (Tsui, Egan, & O'Reilly, 1992; Tsui & O'Reilly, 1989; Wagner, Pfeffer, & O'Reilly, 1984) found that differences in age among employees hindered communication and social integration and resulted in lower commitment and greater turnover among employees.

Basing their arguments on the principle of homophily, Liedka (1991) studied the age and education distribution of members recruited to join voluntary organizations such as youth groups, farm organizations, and sports clubs. Using data collected in the 198.5 and 1936 General Social Survey, he found results at the aggregate level, suggesting that members of voluntary organizations were more likely to persuade others similar to their age and education to join the organization. He also found that when people in the same age groups were more densely connected, they were more likely to be represented in voluntary organizations. At the interorganizational level! Galaskiewicz (1979) and Schermerhorn (1977) found that interorganizational links were more likely to occur among individuals nho perceived similarity in religion, age, ethniciry, and professional affiliations.

Gender Homophily

Considerable research has examined the effect of gender homophily on organizational networks. Lincoln and Miller (1979) found that similarities in sex and race of organizational employees were significant predictors of their ties in a friendship network. Brass's (1985a) research indicated that communication networks in an organization were largely clustered by gender.

Several studies have examined the effects of gender homophily on friendship. For instance, Leenders (1996) discovered that gender was a more influential predictor of enduring friendship ties than proximity. In a study of 36 female and 45 male senior managers in two New York state government bureaucracies, Moore (1992) found that "half of the advice cliques and nearly that proportion of cliques in the friendship network contain men only" (p. 53). Ibarra's (1992) research of an advertising agency revealed that even though women reported task-related, communication, advice influence ties with men. they were more likely to select other women in their social support and friendship networks. Men, on

the other hand, were more likely to have instrumental as well as noninstrumental ties with other men. She pointed out that the constraints of social exchange (see earlier section) and the resulting need to be connected with the organization's predominantly male power base often force women to forgo their propensity for homophily in terms of their instrumental relationships.

Some aspects of culture bear on the preceding results. For example, contrary to other findings, research by Crombie and Birley (1992) showed that the network of contacts among female entrepreneurs in Ireland was not different from that of men in terms of size, diversity, density, and effectiveness. Perhaps the reason for this result is that the people in this study were entrepreneurs. However, the women tended to be younger, owners of smaller businesses that had been established for shorter periods of time, and less involved in traditional exterior activities such as belonging to civic organizations. Women also tended to rely on men and women for advice while men consulted largely with other men. In similar fashion, Ethington, Johnson, Marshall, Meyer, and Chang (1996) studied two organizations with different gender ratios. They found that men and women were equally integrated into and prominent in each other's networks in an organization that had an equal ratio of men and women and an equal gender distribution in the power hierarchy. However, in an organization that had a 75%-25% female-to-male ratio, the networks were more segregated and women were more prominent

Extensions to Theories of Homophily

Communication scholars have maintained an enduring interest in the principle of homophily as a theoretical mechanism to explain the emergence of networks. In response to the ongoing focus on workforce diversity, they have invoked this mechanism in the study of gender and race issues. The principle of homophily has also been suggested as a network mechanism that is relevant to researchers interested in the social comparison processes used by individuals to make assessments, for instance, about their perceptions of equity in the workplace. According to equity theory (Adams, 1965), individuals' motivations are a direct function of the extent to which their input (i.e., efforts) to output (i.e., rewards) ratios are commensurate with those of "relevant" others. Social comparison theory (Festinger, 1954) suggests that these relevant others are selected on the basis of being similar, or homophilous, in salient respects. Likewise, social identity theory (Turner & Oakes, 1989) proposes that these relevant others are those who are seen as sharing the same "social identity" as the focal person. Krackhardt and Brass (1994) suggest that the selection of relevant others is constrained and enabled by the networks in which individuals are embedded. Individuals could select as relevant others those with whom they have close communication ties (i.e., a cohesion mechanism) or with others who they see as having similar roles (i.e., a structurally equivalent mechanism).

Several scholars have urged that similarity of personality characteristics be used to explain involvement in communication networks (Brass, 1995b; Tosi, 1992). McPhee and Corman (1995) adopted a similar perspective in an article that drew on Feld's (1981) focus theory to argue that interaction is more likely to occur among individuals who share similar foci, including being involved in the same activities. They found limited support for their hypotheses in a study of church members, suggesting the need for further research.

Theories of Physical and Electronic Proximity

A number of researchers have sought to explain communication networks on the basis of physical or electronic propinquity (Corman, 1990; Johnson, 1992; Rice, 1993a). Proximity

facilitates the likelihood of communication by increasing the probability that individuals will meet and interact (Festinger, Schachter, & Back, 1950; Korzenny & Bauer, 1981; Monge, Rothman, Eisenberg, Miller, & Kirste, 1985). If these interactions were to occur, they would allow individuals the opportunity to explore the extent to which they have common interests and shared beliefs (Homans, 1950). Early research in organizational settings indicated that the frequency of face-to-face dyadic communication drops precipitously after the first 75-100 feet (Allen, 1970; Conrath, 1973). Zahn's (1991) more recent research also demonstrated that increased physical distance between offices, chain of command, and status led to decreased probability of communication. Likewise, Van den Bulte and Moenaert (1997) found that communication among R&D teams was enhanced after they were co-located. Therefore, individuals who are not proximate are deprived of the opportunity to explore these common interests and are hence less likely to initiate communication links. As such, physical or electronic proximity is a necessary but not sufficient condition for enabling network links. Dramatic evidence of the influence of physical proximity involves the physical dislocation of 817 employees of the Olivetti factory in Naples following the 1983-1984 earthquakes. Bland et al. (1997) report that employees who were permanently relocated rather than evacuated only temporarily reported the highest distress levels due to the disruption in their social networks. Rice (1993b) notes that physical proximity may also facilitate contagion (see section above) by exposing spatially co-located individuals to the same ambient stimuli. Rice and Aydin (1991) found modest evidence of the role played by physical proximity on employees' attitudes toward a new information system. At the interorganizational level, Palmer et al. (1986) found that interlock ties were more likely to be reconstituted if departing members represented organizations whose headquarters were physically proximate to that of focal organizations.

The effects of new communication technologies on the creation and modification of social networks are well documented (Barnett & Salisbury, in press; Rice, 1994a; Wellman et al., 1996). Less intuitive, but just as evident, are the effects of new technologies in preserving old communication structures. In a study of three sectors of the UK publishing industry (the book trade, magazine and newspaper trade, and the newsprint suppliers), Spinardi, Graham, and Williams (1996) found that the introduction of electronic data interchange consolidated and further embedded existing interorganizational relationships, thereby preventing business process reengineering.

Extensions to Theories of Proximity

The proliferation of information technologies in the workplace capable of transcending geographical obstacles has renewed interest in the effects of physical and electronic proximity and their interaction on communication patterns (Kraut, Egido, & Galegher, 1990; Steinfield & Fulk, 1990). Fulk and Boyd (199 1) underscored the potential of network analysis "to test the situational moderating effect of geographic distance on media choice" (p. 433). Corman (1996) suggested that cellular automata models are particularly appropriate for studying the effects of physical proximity on communication networks. Cellular automata models can be used to study the collective and dynamic effects of proximity on the overall communication network when individuals in the network apply theoretically derived rules about creating, maintaining, or dissolving links with their "local." that is, proximate, network neighbors.

Uncertainty Reduction and Contingency Theories

Uncertainty about individual and organizational environments has played an important role in explaining organizational processes. Two theories have incorporated communica-

tion network concepts to explain how people reduce this uncertainty. Uncertainty reduction theory (URT) and contingency theory are reviewed in this section.

Uncertainty Reduction Theory

URT (Berger, 1987; Berger & Bradac, 1982) suggests that people communicate to reduce uncertainty thereby making their environments more predictable (Weick, 1979). Researchers have examined how communication networks help manage and reduce the organization's uncertainty (Leblebici & Salancik, 1981; Miller & Monge, 1985). However, as Albrecht and Hall (1991) note, "innovation, and especially *talk* about innovation, is inherently an uncertainty-producing process" (p. 537). As a result, Albrecht and Ropp (1984) found that communication about innovation is most likely to occur among individuals who have strong multiplex ties (i.e., both work and social ties) that guarantee them a level of relational certainty and thereby greater perceived control in a potentially uncertain situation. Albrecht and Hall (1991) found evidence that the need to reduce uncertainty also explained the creation of dominant elites and coalitions in innovation networks. Burkhardt and Brass (1990) chronicled the changes in the communication network following the introduction of a new technology. They found that the uncertainty resulting from the introduction of the technology motivated employees to seek out new contacts and hence change their communication networks. Kramer (1996) found that the employees who had experienced job transfers were more likely to have positive attitudes about the adjustment if their reconstituted network offered the quality of communication that reduced their uncertainty.

At the interorganizational level, Granovetter (1985) argued that organizational decision makers use social networks to reduce uncertainty associated with market exchanges, thereby reducing their transaction costs (see earlier discussion). Picot (1993) suggested that network organizations were superior to markets and hierarchies when task uncertainty was high and task specificity was low. In a study of relationships between firms and their investment banks, Baker (1987) reported that the firms' financial officers often drew on their informal networks to reduce uncertainty surrounding the creation of a market tie. The reduction of uncertainty due to strong ties was also useful to explain the reduction of interorganizational conflict. Using data from intergroup networks in 20 organizations, Nelson (1989) found that organizations with strong ties between their groups were less likely to report high levels of conflict than those organizations that had groups that were connected by weak ties.

Contingency Theory

In the early 1960s, organizational scholars began to focus their attention on the environment and ways to reduce the uncertainty it created. Emery and Trist (1960) developed sociotechnical systems theory in which they argued that the nature of an organization's environment significantly influences its structure and operations (Emery & Trist, 1965). A contingency theory approach to formal organizational structures is based on the premise that an organization should structure itself in a manner that maximizes its ability to reduce the uncertainty in its environment. For example, Burns and Stalker (1961) contrasted "organic" with bureaucratic organizations, which they labeled "mechanistic." The defining feature of organic organizations was that their structures were internally adaptable to changing features of the environment while mechanistic organizations were not. Lawrence and Lorsch's (1967) contingency theory formalized this view and argued that all internal relations and structures were contingent on external conditions. Galbraith (1977) argued that organizations needed to develop slack resources and flexible, internal lateral communication networks to cope with environmental uncertainty. Thus, the theoretical mechanism in contingency theory that accounted for the

formation, maintenance, and eventual dissolution of communication networks was the level of uncertainty in the organization's environment. Stable environments led organizations to create long-standing, entrenched networks, while turbulent environments led organizations to create flexible, changing networks.

In an empirical study of Burns and Stalker's distinction between mechanistic and organic organizations, Tichy and Fombrun (1979) found that the differences between the formal and informal communication networks were more pronounced in mechanistic organizations than they were in organic organizations. Barney's (1985) inductive blockmodeling, clustering, and scaling techniques identified the dimensions of informal communication structure in interaction data collected by Coleman (1961) from the entire student population of ten Midwestern high schools. One dimension identified was "analogous to Burns and Stalker's (1961) organic-mechanistic dimension of formal structure" (Barney, 1985, p. 35), which proved to be consistent with contingency theory's proposed relationship between environmental diversity and formal organizational structure (Miles, 1980).

Shrader, Lincoln, and Hoffman (1989) tested Bums and Stalker's argument that organic forms of organizational structure would result in informal organizational communication networks that were denser, more highly connected, and more multiplex than those found in mechanistic organizations. They found that organic "smaller organizations made up of educated staff applying nonroutine technologies have denser, more cohesive, and less-segmented networks consisting largely of symmetric or reciprocated ties" (p. 63). By contrast, vertically and horizontally differentiated, as well as formalized, mechanistic organizations were less densely connected, more segmented, and less likely to have symmetric and reciprocated communication ties.

Contingency theory's proposed relationship between technology and the organization's structure was examined in a study by Brass (1985b). Using network techniques to measure pooled, sequential, and reciprocal interdependencies in an organization's workflow, Brass (1985b) found that the relationship between interpersonal communication and performance was contingent on the extent of horizontal differentiation in the organization's structure and the coordination requirements of the task.

Extensions to Uncertainty Reduction and Contingency Theories

The review above suggests that the deployment of uncertainty reduction theory was more prevalent in the 1980s and has been on the decline lately. This decline corresponds, not coincidentally, with the increasing critique of the scope and operationalization of the "uncertainty" concept (Huber & Daft, 1987). Future network research from an uncertainty reduction perspective should respond to calls for a conceptual delineation between uncertainty reduction and equivocality reduction (Weick, 1979). The relative efficacy of networks to help reduce uncertainty and equivocality is a potentially useful but as yet untapped area of inquiry. Further, past network research based on uncertainty reduction theory has not distinguished between uncertainty reduction and uncertainty avoidance (March & Weissinger-Baylon, 1956). The use of communication networks to reduce uncertainty implies the presence or creation of links, while the avoidance of uncertainty may imply the absence or dissolution of links.

Although the research literature testing the validity of the contingency mechanism is sparse, it tends to support the importance of internal adaptability to external constraints. In fact, most theorists today accept the contingency thesis without significant empirical support because the enormous increase in the rates of environmental change in the contemporary world makes it seem intuitively obvious. No subsequent theory has argued against the contingency mechanism, and Galbraith's

(1977) extensive analysis of the development of slack resources and deployment of lateral communication linkages remains the clearest statement of how to develop communication networks to cope with rapidly changing environmental uncertainty.

Social Support Theories

Interest in social support networks can be traced back to Durkheim's (1897/1977) groundbreaking work on the impact of solidarity and social integration on mental health. A social support explanation focuses on the ways in which communication networks help organizational members to cope with stress. Wellman (1992) and others have adopted this framework in their study of social support networks. Their research is largely based on the premise that social networks play a "buffering" role in the effects of stress on mental well-being (Berkman & Syme, 1979; Hall & Wellman, 1985).

Two general mechanisms exist by which social networks buffer the effects of stress. First, an individual in a dense social support network is offered increased social support in the form of resources and sociability. Lin and Ensel's (1989) research produced evidence that strong ties in the support network provided social resources that helped buffer both social and psychological stress. Second, Kadushin (1983) argued that social support can also be provided by less dense social circles. Social circles (Simmel, 1955) are networks in which membership is based on common characteristics or interests. Membership in a social circle can help provide social support "by (1) conveying immunity through leading the members to a better understanding of their problems, (2) being a resource for help, or (3) mobilizing resources" (Kadushin, 1983, p. 191).

A substantial amount of research exists on the role of networks in providing social support in varying organizational contexts, such as families, communities, and neighborhoods (for reviews, see O'Reilly, 1988; Walker, Wasserman, & Wellman, 1994). In a classic longitudinal study of residents in a northern California county, Berkman and Syme (1979) found that respondents "who lacked social and community ties were more likely to die in the follow-up period than those with more extensive contacts" (p. 186). Berkman (1985) found that individuals with fewer social support contacts via marriage, friends, relatives, church memberships. and associations had a higher mortality rate.

Researchers (Barrera & Ainlay, 1983; Cutrona & Russell, 1990; Wellman & Wortley, 1989, 1990) have identified four dimensions of social support, including emotional aid, material aid (goods, money, and services), information, and companionship. Considerable empirical evidence demonstrates that individuals cannot rely on a single network link, except to their parents or children, to provide all four dimensions of social support. Studies by Wellman and Wortley (1989, 1990) of a community in southern Ontario, Canada, found that individuals' specific network ties provided either emotional aid or material aid, but not both. Additionally, studies have found that women are more likely to offer emotional aid than men (Campbell & Lee, 1990).

Remarkably few srudies have examined networks of social support in organizational contexts even though several scholars have underscored the need for research in this area (Bass & Stein, 1997). For example, Langford, Bowsher, Maloney, and Lillis (1997) propose the examination of networks to study social support in nursing environments such as hospitals and nursing homes. A comparison of six hospital units by Albrecht and Ropp (1982) found that the volume and tone of interaction in the medical surgical unit's communication network improved their ability to cope with chronic pressures and stress. In one of the few studies of social support networks in organizations, Cummings (1997) found that individuals who reported receiving greater social support from their network were more likely to generate radical (i.e.. "frame-breaking") innovation.

Hurlbert (1991) used ego-centric network data for a sample of respondents from the 1985 General Social Survey (the first national sample containing network data) to examine the effect of kin and coworker networks on stress, as measured by individuals' job satisfaction. She argued that individuals' networks may (a) provide resources to decrease the level of stress created by job conditions, or(b) p rovide support thereby helping the individual cope with job stress. She found that membership in a coworker social circle was positively associated with job satisfaction, even after controlling for other social and demographic variables. The effect on job satisfaction was even higher if the coworkers were highly educated, suggesting that they were able to offer additional instrumental resources. However, Hurlbert (1991) also found that for individuals who were in blue-collar jobs or those with low security, "kin-centered networks may exacerbate, rather than ameliorate, negative job conditions" (p. 426). Consistent with this latter finding, Ray (1991) and Ray and Miller (1990) found that individuals who were highly involved in networks offering social support to friends and coworkers were more likely to report high levels of emotional exhaustion. The negative effects of the network on individuals were also reported in a longitudinal study of relatively well-functioning older men and women. Seeman, Bruce, and McAvay (1996) found that men who had larger instrumental support networks were more likely to report the onset of activities of daily living disability. They speculated that these results may reflect "the consequences of greater reliance on others, a behavior pattern which may, over time, erode the recipient's confidence in their [sic] ability to do things independently" (pp. S197-S198).

At the interorganizational level, Eisenberg and Suanson (1996) noted that Connecticut's Healthy Start program served an important social support role for pregnant women by serving as referral to hospitals and agencies. Zinger, Blanco, Znnibbi, and Mount (1996) reported that Canadian small businesses relied more heavily on an informal support network than government programs. Paterniti, Chellini, Sacchetti, and Tognelli (1996) described how an Italian rehabilitation center for schizophrenic patients successfully created network links with other organizations to reflect "the social network that surrounds the patient and from which he [sic] has come" (p. 86).

Extensions to Social Support Theories

The amount of research on social support networks has increased substantially in the past few years. Some of these changes are perhaps motivated by changes in the organizational landscape, such as the increase in outsourcing, telecommuting, job retraining for displaced workers (Davies, 1996), and small business start-ups (Zinger et al., 1996). All of these activities often serve to isolate the individual worker from the institutional support structures of traditional organizations. Hence, there is greater salience today for improving our understanding of the role of social support mechanisms in the emergence of networks.

Early research on the role of networks in providing social support focused on structural characteristics of the networks, such as tie strength, frequency, reciprocity of the links, the size, and the density of the networks. Walker et al. (1994) noted that recent network research has abandoned the notion of social support as a unitary construct as well as the assumption that the presence of a tie can be equated with the provision of social support. Instead, they model social support as "a complex flow of resources among a wide range of actors rather than as just a transaction between two individuals" (p. 54). Indeed, in a study of low-income, immigrant women Vega, Kolody, Valle, and Weir (1991) found that the women's overall frequency of interaction with friends and family was not correlated with levels of depression. However, the quality of social support, measured as the frequency of specific social support messages, was the best predictor of low depression scores among the women.

Theories of Network Evolution: Emergent Versus Emergence

In a special issue of the *Journal of Mathematical Sociology*, "The Evolution of Networks," Stokman and Doreian (1996) examined the distinction between the terms *network dynamics* and *network evolution*. They argued that the study of network dynamics provides a quantitative or qualitative temporal characterization of change, stability, simultaneity, sequentiality, synchronicity, cyclicality, or randomness in the phenomena being observed (Monge & Kalman, 1996). The focus is on providing sophisticated descriptions of the manifest change in networks. In contrast, Stokman and Doreian define the study of network evolution to contain an important additional goal: an explicit, theoretically derived understanding of the mechanisms that determine the temporal changes in the phenomena being observed. While most of the longitudinal network studies reviewed in this chapter contain theoretical mechanisms to explain changes over time, many of them could be more explicit about this connection and move more in the direction of fully developed theories of network evolution.

In an early example, Fombrun (1986) theorized about evolution in terms of infrastructures, sociostructures, and superstructures that interacted dynamically with each other across organizational, population, and community levels. He identified two dynamically opposing forces that led both to conflict and to eventual resolution: processes of convergence and processes of contradiction. In a more recent example, Salancik (1995) critiqued the intellectual contributions of Burt's (1992) structural theory of holes. He noted that it was important to acknowledge Burt's finding that a person occupying a structural hole will gain political advantage, but he also asserted that "a more telling analysis might explain why the hole exists or why it was not filled before" (Salancik, 1995, p. 349). Salancik challenged network researchers to invest efforts in creating a more specific network theory. Such a theory does not take a network as given. Instead, it seeks to uncover the mechanisms that create network evolution.

Two of the more comprehensive reviews of network studies have called for greater attention to the evolution of networks (Brass, 1995b; Monge & Eisenberg, 1987). While both were organized around antecedents and outcomes of networks, they acknowledged that such distinctions are often nonexistent and potentially misleading. Monge and Eisenberg (1987, p. 3 10) offered a hypothetical scenario to illustrate the ongoing evolution of a network, a concept they term *reorganizing*. Brass (1995b) underscored the importance of articulating the dynamic nature of the relationships between networks, their antecedents, and outcomes.

Four lines of research emphasize the importance of this perspective. The first articulated a recursive model of communication networks and media (Contractor & Eisenberg, 1990). Drawing on structuration theory (Giddens, 1983) and the theory of structural action (Burt, 1982), they proposed that while networks influence individuals' adoptions, perceptions, and use of new media, this use has the potential for altering the very networks that precipitated their use in the first place. In some instances, this altered network has the potential of subverting individuals' continued use of the media. Hence, the coevolution of communication networks and the activities they shape are inextricably linked and must be examined as a duality.

Similarly, Barley (1990) and Haines (1988) have argued for the use of network analytic techniques to articulate and extend structuration theory. Barley (1990) used network analytic tools to describe the situated ways in which relatively small role differences in initial conditions reverberated through seemingly similar social systems, resulting over time in widely different social structures. Barley (1990) rejected contingency theories because they offer static predictions of a match between technologies and social structures. Instead, he argued for using networks as a way of making explicit the theory of negotiated order (Fine & Kleinman, 1983).

According to this theory, structures are by-products of a history of interactions and are subsequently perceived as fact by organizational members. However, he notes that theories such as structuration or negotiated order provide few analytic tools for explicating the links between the introduction of a technology, the interaction order, and the organization's structure. He offers network analytic tools as one way of explicating these links. Barley (1990) chronicled how the material attributes of a CT scanner recently adopted in two radiology departments affected the nonrelational elements of employees' work roles, including their skills and tasks; this, in turn, affected their immediate communication relationships and precipitated more widespread changes in the department's social network. Significantly, his analysis explains why the technology was appropriated differently in the two radiology departments. Barley's empirical work exemplifies several symbolic interactionists who argue for the importance of understanding the emergence of social order as a process of social construction (Berger &Luckmann, 1966; Giddens, 1976, 1984).

From Barley's (1990) standpoint, network techniques offer an opportunity to illustrate the ideographic and idiosyncratic nature of organizational phenomena. The ideographic assumption reflects an ontological viewpoint that rejects the nomothetic goal of seeking generalizable regularities in explaining organizational phenomena. Instead, the goal of the researcher with an ideographic viewpoint is to understand the processes that unfold in the particular organization being studied. Zack and McKenney (1995) offer a more recent example of work in this tradition. They examined the appropriation of the same group-authoring and -messaging computer system by the managing editorial groups of two morning newspapers owned by the same parent corporation. Drawing on Poole and DeSanctis' (1990) theory of adaptive structuration, they discovered that the two groups' appropriation of the technology, as indexed by their communication networks, differed in accordance with the different contexts at the two locations. Further, they found evidence that the groups' performance outcomes for similar tasks were mediated by these interaction patterns.

A second line of research embraces the central precept of focusing attention on evolution of networks, but seeks nomothetic, that is, lawful and generalizable, underlying theoretical mechanisms to explain the appearance of seemingly ideographic, nongeneralizable, surface phenomena (Stokman & Doreian, 1996). These authors argue for the development of computational models that incorporate network mechanisms that both influence and are influenced by people in the social network. This line of research extends recent work in object-oriented modeling, cellular automata (CA), and neural networks to capture the ongoing, recursive, and nonlinear mechanisms by which organizational networks evolve over time (Abrahamson & Rosenkopf, 1997; Banks & Carley, 1996; Corman, 1996; McKelvey, 1997; Stokman & Zeggelink, 1996; Woelfel, 1993). Banks and Carley (1996) compared three mathematical models of network evolution based on social comparison theory (Heider, 1958), exchange theory (Blau, 1964), and constructuralism (Carley, 1990, 1991). They noted that the pattern of network evolution associated with the three models were not always distinct, thereby making it difficult to empirically validate one model over the other. They offer statistical tests that, at the very least, allow for the falsification of a particular model.

Corman (1996) suggested that multidimensional CA models offer insights into the unanticipated consequences of collective communication behavior. His computer simulations of a simplified CA model based, in part, on Giddens's structuration theory, suggested that integrationist strategies by individuals were, unintentionally and perversely, most responsible for segregation in communication structures.

Zeggelink, Stokman, and Van de Bunt (1996) modeled the likelihood of various configurations of friendship networks that may emerge among an initial set of mutual strang-

ers. Their stochastic model deployed network mechanisms of selection and contagion to explain the creation, maintenance, and dissolution of friendship ties among the individuals. The complex specifications of such models make it impossible to mentally construe the long-term dynamics implied by the models. Further, given the nonlinearities implied by the mechanisms, these models are often analytically intractable. Hence, researchers use computer simulations to help assess the long-term evolutionary implications of the proposed network mechanisms. For instance, Stokman and Zeggelink (1996) developed simulations and then empirically tested the network configuration of policy makers charged with determining the fate of a large farming cooperative in the Netherlands. This research (see also Robinson, 1996) is based on the assumption that ideographic differences in the dynamics of friendship networks can be adequately explained and stochastically predicted by nomothetic underlying network mechanisms.

The use of computer simulations to study the evolution of networks requires considerable programming knowledge by researchers. To make these efforts more accessible to a larger community of researchers, Hyatt, Contractor, and Jones (1997) have developed an object-oriented simulation environment, called Blanche (available online at http://www.tec.spcomm.uiuc.edu/blanche.html). Blanche provides an easy user-interface to support the specification of mathematical models, execution simulations, and the dynamic analysis of the network evolution.

A third line of research examines the evolution of organizational networks as a function of the stage in an organization's life cycle. Monge and Eisenberg (1987) suggested that at early stages organizations are likely to have structures that are less stable and formal. Building on this suggestion, Brass (1995b) noted that structuration theory would suggest that these patterns would become more stable and formalized as organizations mature.

A fourth line of research focuses on the emergence of network organizations, such as strategic alliances, partnerships, and research consortia, in lieu of discrete market transactions or internal hierarchical arrangements. Ring and Van de Ven (1992, 1994) focused attention on the developmental processes of interorganizational relations: emergence, evolution, and dissolution. They proposed, as a framework for this process, "repetitive sequences of negotiation, commitment, and executions stages, each of which is assessed in terms of efficiency and equity" (p. 97). Drawing on much of the same literature, Larson and Starr (1993) proposed a model to explain the emergence of entrepreneurial organizations. Finally, Topper and Carley (1997) described the evolution of a multiorganization network organization in a hyperturbulent environment: the integrated crisis management unit network that responded to the Exxon *Valdez* disaster.

The four streams of research reviewed in this section share an intellectual commitment to a better understanding of the situational evolution of organizational networks. Future research that combines this commitment to situated evolution with the theoretical mechanisms reviewed in this chapter has the potential to significantly extend our knowledge of organizational communication networks and the explanatory power of our models and theories.

CONCLUSION

This chapter has focused on emergence Of communication networks-their creation, maintenance, and dissolution-within and among organizations. Ten major families of theories were reviewed to explore the theoretical mechanisms that have been used by network scholars to examine these evolution. ary processes in organizational communication networks. Six conclusions seem warranted from this review.

First, the literature reviewed in this chapter focuses much more on the creation of networks than their maintenance or dissolution. This imbalance reflects a serious shortcoming

in current theoretical perspectives and empirical research. Theories that describe conditions under which the likelihood of creating network links is lower rather than higher must be examined more carefully to see if these conditions also predict the dissolution of network links. The Seabright et al. (1992) research, reviewed earlier, offers a notable example of such an attempt. Their study found evidence that reductions in the resource fit between organizations would lead to pressures to dissolve interorganizational network links.

Second, considerable additional work is required to reduce or eliminate the extensive redundancy that exists among the different theoretical perspectives. For example, as discussed earlier, the theoretical mechanisms in exchange theory and social support theory share a great deal in common with each other. Likewise, homophily, which is defined as similarity of individual characteristics, can be viewed as conceptually overlapping with proximity, which can be viewed as similarity of location. Other examples abound in this review. Some of this redundancy stems from conceptual vagueness, as was mentioned earlier with the notion of uncertainty. Other aspects of redundancy are attributable to the fact that the theories were developed in different contexts, as is the case for network organizational forms, which clearly use exchange mechanisms though they emerged out of interests in economic markets and transaction costs. Still another source of overlap is that different theories were developed in different disciplinary traditions, including communication, economics, political science, social work, and sociology, to name but a sample.

The third conclusion is that the time may have come to explore a mote eclectic, multitheoretical approach to network theory in which several theories are used simultaneously to predict communication network behavior and outcomes. While elimination of conceptual and theoretical redundancy will be beneficial, it seems unlikely to produce a general, integrated theory (and there are those who argue in principle that such a feat is impossible). None of the theories reviewed in this chapter, by themselves, seem sufficiently powerful to explain large portions of the variance in network emergence. Nor do they individually seem capable of predicting the emergence, maintenance, and dissolution of communication networks with anything near a reasonable level of precision. Consequently, an integrative, multitheoretical alternative appears worth exploring. A multitheoretical approach would use different theories to account for different aspects of network phenomena or to account for the same aspects at different points in the evolutionary process. There is some precedence for this strategy in the public goods literature, which examines one set of mechanisms for the creation of public goods but an alternative set for their maintenance (Monge et al., 1998).

A fourth conclusion is that it is important to focus attention on uniquely network forms of communication network theory. This review has highlighted the fact that most theoretical explanations for communication networks, though not all, stem from nonnetwork theories applied to network phenomena. More theoretical effort is required like the work that helped to develop network exchange theories, structural holes theory, and network evolution theories. Wasserman and Pattison (1996) have recently made important contributions in this direction with the development of "p*" models, which explore how the various endogenous characteristics of a matrix of network relations, together with other exogenous explanatory variables, shape the outcomes of the network.

Fifth, much work needs to be done to develop network theories that bridge the expansive analytic levels covered by network analysis. In one sense, the fact that networks span such diverse phenomena and operate on so many levels underscores their importance in everyday life. On the other hand, these expansive and multilevel qualities make theoretical integration a very challenging task. Theories that range from internal cognitive social structures to global network organizations make formidable intellectual leaps that need careful examination and theoretical development.

Finding commonalities as well as disjunctures across levels will be an important part of building a more integrated theory of communication networks.

Finally, as the literature reviewed here demonstrates, the study of emergence in communication networks continues to be overwhelmingly influenced by structural perspectives. Of the three network traditions employed throughout this chapter, the positional and relational traditions continue to dominate, while the cultural tradition has struggled to bridge the gap between structure and the content of communication networks. The theoretical mechanisms used in network research invest greater currency in the structural relationships among people than on the types of network linkages (e.g., material vs. symbolic, product vs. knowledge; see the earlier discussion in this chapter) or the content of the messages within these networks. Wellman (1988) notes that the genesis for this bias goes back to Georg Simmel's influence on the pioneers of network research (e.g., Simmel, 1955). In fact, Wellman (1988) characterizes the early work of an influential minority of formalists (e.g., Fararo, 1973; Holland & Leinhardt, 1979; Lorrain & White, 1971) by asserting that in "concentrating on the form of network patterns rather than their content. . they have shared a Simmelian sensibility that similar patterns of ties may have similar behavioral consequences no matter what the substantive context" (p. 25). Even the network studies based on the cultural tradition (e.g., semantic networks) are largely focused on structural explanations for the emergence of these networks, despite the fact that they are based on network linkages representing common interpretations. They seek to explain variation in the structure of the semantic networks rather than variation in the content (e.g., types of linkages or messages) within these networks. Missing from the network literature is any systematic theoretical or empirical work aimed at examining the relationship between the structure of networks and the content of messages, symbols, and interpretations that produce and reproduce them. Consequently, we know very little about the manner in which different network configurations (e.g., centralized networks, dense networks) are likely to facilitate the creation of certain types of messages (e.g., supportive, critical). Conversely, little is known about how the production and reproduction of certain types of messages or symbols are likely to influence the structural emergence of communication networks.

The field of organizational network analysis has grown exponentially since the original chapter on emergent communication networks was published in the *Handbook of Organizational Communication* more than a decade ago (Monge & Eisenberg, 1987). The diversity of scholars from various intellectual backgrounds who are currently developing theories of communication and other networks in organizations is truly impressive, as is the high quality of their work. Even more important, as this review has demonstrated, is the development and application of theories and theoretical mechanisms in what once was a very atheoretical field. There is, of course, a great deal remaining to be done. But continued work in these theoretical areas, with special attention to network evolution, promises to make the years ahead a very exciting time for organizational communication network scholars.

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