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# 7. Communication Networks and New 'Media in Organizations

*The Street finds its own uses for things-uses the manufacturers never imagined. The microcassette recorder, originally intended for on-the-jump executive dictation, becomes the revolutionary medium of magnizdat, allowing the covert spread of suppressed political speeches in Poland and China. The beeper and the cellular telephone become tools of an increasingly competitive market in illicit drugs. Other technological artifacts unexpectedly become means of communication, either through opportunity OF necessity. The aerosol can gives birth to the urban graffiti matrix, Soviet rockers press homemade flexi-discs out of used chest X-rays. (Gibson, 1989, p. 85)*

## Introduction

There is no such thing as pure technology. To understand technology, one must first understand social relationships. Understanding social relationships requires a grasp of communication. Everything about the adoption and uses of media is social (e.g., Contractor, Fulk, Monge, & Singhal, 1986; Ebadi & Utterback, 1984; Fulk, Steinfield, Schmitz, & Power, 1987; Kling & Scacchi, 1982; Markus & Robey, 1988). Logical expectations for the adoption and use of the new media are rarely met (Kiesler, 1986; Rogers, 1988; Watson, DeSanctis, & Poole, 1988). The pragmatics of technological communication must always be understood in the context of the motives, paradoxes, and contradictions of everyday life.

On the one hand, individuals use media within the framework of their lives, to accomplish their personal goals (i.e., to get ahead, to be liked, to pass the time). On the other, technology shapes individuals' goals and actions, their wishes and behaviors; both the tool and the person using the tool are changed through its application (Barley, 1986; Ochs, 1989; Rice & Contractor, in press).

The aim of this chapter is to explore in detail the interplay between the social environment and the application of communication technologies in

organizations. We begin with the well-accepted idea that interaction patterns influence social practices. We add to this a plea for recursivity. When the practices being shaped are themselves communicative (as is the case with communication technologies), changes in these practices directly shape these very same social relations.

Acomplete discussion of communication and its relationship to technology is beyond the scope of this or any one chapter. Consequently, we choose to focus on what is but one way of articulating or operationalizing the social environment within which technologies are implemented-communication networks, the interaction patterns that surround the adoption and use of media. Specifically, we set our sights on the role emergent communication networks play (Monge & Eisenberg, 1987) in influencing (and being influenced by) new media in formal organizations.

Toward this end, the chapter is divided into two sections. The first section presents our main argument, that the relationship between communication networks and new organizational media is fundamentally emergent and recursive, best understood as part of the "duality of structure" that constitutes organizing. The second section is a more detailed review of the theoretical connections between networks and organizational media.

## Technology and the Duality of
## Structure in Organizations

Prior research addressing the *role* of technology in organizations has not always proceeded from a strong theoretical basis. In the recent *Handbook* of *Communication* Science, Chaffee and Berger (1987) comment on the conspicuous absence of a chapter on technology this way:

> Several of our authors consider technological impacts in their particular domains of inquiry. Perhaps this is as it should be for now. While it is obvious that new technologies will have considerable impact. . . this concern is currently devoid of a unique theoretical focus. (p. 893)

This section describes the dominant theoretical approaches that focus on media characteristics; highlights one approach specifically applicable to communication networks, social information processing theory; and offers a new, recursive model of the relationship between communication network participation and media use in organizations.

### Media Characteristics

If there is an over-riding theme in past research, it is the ongoing attempt to match media characteristics with task characteristics within organizations. Those theoretical statements that do exist classify the media and the communication requirements of tasks on the basis of social presence (Short, Williams, & Christie, 1976) or media richness (Daft & Lengel, 1986). In other words, media characteristics such as asynchronicity, channel capacity (audio versus visual versus audiovisual), and the opportunities for feedback are catalogued in an attempt to determine the social presence or richness of the media. Likewise, communication tasks are classified on the basis of their characteristics (such as "getting acquainted," "seeking factual information," or "negotiating"). Empirical research tests hypotheses about the effectiveness of specific media to accomplish certain communication tasks. Clearly this model is based on the assumptions that each medium has an "objective" social presence and each communication task a single goal.

Neither assumption is borne out in communicative practice. The idea that specific media or messages can be understood in terms of their ability to simply transmit information has been rejected as an inappropriate, "conduit" metaphor of organizational communication (Axley, 1984). There are at least three problems with this model.

First, it assumes a passive receiver. We believe that audiences actively co-construct the meanings of the messages they receive. This means that when you interact with someone, you don't have everything planned ahead of time-new ideas emerge in the exchange, precisely because it is a dialogue. Second, the conduit model of communication does not sufficiently account for the role played by the local context in determining the meaning of any given communication. To suggest that meaning is transferred from 'head to head" greatly underestimates the moderating effects of the situation on the meanings that are constructed. Third, and finally, the conduit metaphor is symbolic of an ideology of clarity and openness that equates these qualities of communication with effectiveness. We maintain that communication can be political, strategic, and effective without being open or clear (Eisenberg & Witten, 1987). Furthermore, it is these more subtle instances of strategy that reveal most about the functions of communication in organizations.

Along these lines, then, we question the assumption that the channel which provides the most nonverbal cues (i.e., face-to-face communication) will also by definition be the most effective communication medium. In some

instances, a medium that filters cues (such as computer-conferencingl may be *more* effective than face-to-face communication in achieving strategic **goals.** Most previous research has assumed at least implicitly that the effectiveness of face-to-face communication be used as a benchmark to compare the effectiveness of all mediated communication. We question research based on the notion that media that filter cues may substitute, but cannot supersede and are always in some way inferior to face-to-face communication (Culnan & Markus, 1987).

Our final difficulty with the media characteristics approach has to do with our belief that communicators in organizations always have multiple goals (Eisenberg, 1984). Previous work has assumed that at any given moment, individuals are trying to accomplish just one thing; that is, to "gain compliance, " "ingratiate," or "save face." But the general case of organizational communication is significantly more complex, with multiple goals and strategies commonly enacted simultaneously in a single communication situation. Speaking to your subordinate about a work assignment, for example, may require attention to relational goals (such as the subordinate's feelings), as well as more instrumental goals (such as ensuring an effective plan of action). Past research has attempted to identify the most appropriate medium to achieve these goals each taken individually. Since these goals rarely, if ever, occur independently, we advocate studying how combinations of media are used over time to accomplish a complex profile of goals.

## Social Information Processing

Echoing broader criticisms of overly rational models of organizational behavior, Fulk et al. (1987) offer a significant theoretical advance over this work. They point out that previous approaches assume "objective" definitions of media and task characteristics, neither of which exist in pure form. Instead, these characteristics are socially constructed through the information people receive about them. Citing a simple example, if a senior manager learns from her peers that the electronic mail system is "too darned complicated" to use interactively, she may in turn develop a similar attitude and pattern of usage reflecting this negative perception.

Fulk et al. (1987) apply Salancik and Pfeffer's (1978) social information processing theory to explicate the influence of the sociocommunicative environment on behavior with new media. This is a novel application of the theory, which had previously been reserved for the study of task characteristics and job attributes (e.g., Miller & Monge, 1985). There are two limitations to the theory as Fulk et al. (1987) have applied it. First, because it is not explicitly a communication theory, social information processing has not articulated the mechanisms by which social information flows to and from individuals. Second, while highlighting the important effects of social information on patterns of media use, Fulk et al. fail to consider influences in the opposite direction; how patterns of media use in turn effect patterns of social interaction and information. We have developed a model that responds in part to both of these concerns.

## A Recursive Model of Communication Networks and Media

We propose a simple, recursive model that extends the social information processing approach in two ways (see Figure 7.1). First, we apply communication network concepts as one way of specifying the social mechanisms by which individuals' perceptions and behaviors with new media are shaped. Second, we describe the manner in which individuals' use of the media in turn influences their positions in emergent communication networks. Underlying both of these moves is our contention that the social environment and applications of communication technologies are recursively linked to each other and to other organizing processes through the "duality" of social structure. This duality has well-known roots, three of which are discussed below.

Giddens' *Structuration.* Antony Giddens (1984) is best known for his metatheory: structuration. Structurationists (Barley, 1986; Ranson, Hinings, & Greenwood, 1980; Poole, Seibold, & McPhee, 1986; Riley, 1983) see social interaction as a kind of prism through which individual and communal ends are refracted to create social reality. Organizing consists of an unresolved dialectic between autonomy and interdependence, agency and constraint. According to Giddens, "Human social activities, like some self-reproducing items in nature, are recursive. That is to say, they are not brought into being by social actors but continually recreated by them via the very means whereby they express themselves as actors. In and through their activities agents reproduce the conditions that make these activities possible" (Giddens, 1984, p. 2). And so it is with the relationships between communication structure and uses of organizational media-each shapes the other in an emergent pattern of mediated and non-mediated social interaction.

Burt's Theory *of Structural Action.* In the network domain, we trace our argument to Burt's (1982) theory of structural action, which also features the recursive nature of social structures. Burt argues that "social structures constrain actors in their ability to take (purposive) action," but also that
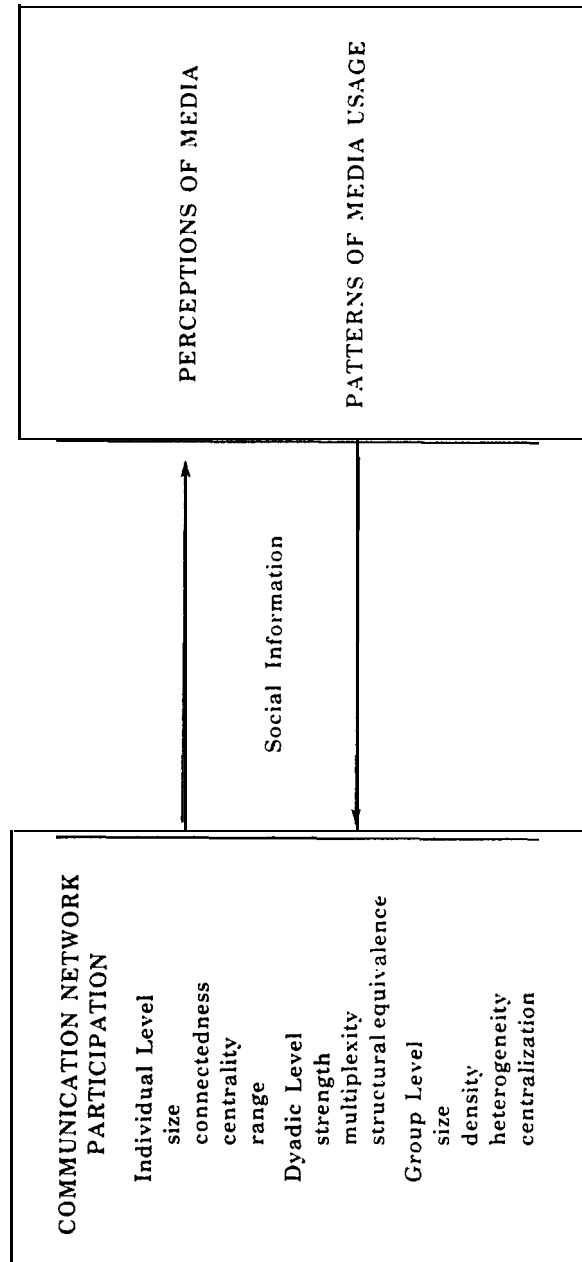
**Figure 7.1** A Recursive Model of Network Involvement and Media Use in Organizations

"actions taken under social structural constraint can modify social structure itself and these modifications have the potential to create new constraints to be faced by actors within the structure" (p. 9). Burt's theory echoes Giddens' structuration theory on the processual recursive character of the interaction between agency and structure. There are some important differences, however. Burt (1982) draws his ideas more from a morphogenetic view of recursivity, one which has a decidedly sequential flavor (Archer, 1982). In this way, the dialectical interplay between agency and constraint can be analyzed cycle by cycle. Structuration, on the other hand, focuses more on the nonsequential interpenetration of agency and constraint. For example, when employees use a new communications medium, from this perspective their use at once reflects a history of constraint and opens up a wealth of future possibilities.

Our use of the term recursive, then, is meant to encompass both notions of sequentiality *and* simultaneity. In addressing relationships between social structure and media use, we are interested both in cycles and sequences of effects and in the moment-to-moment interpenetration of agency and constraint

*Technology* as *Tool.* Finally, we borrow the tool/container distinction as it has been applied to language and offer it here as a way of understanding technology (Ochs, 1989). A tool-like conception of language sensitizes us to the ways in which people use words to shape their worlds. But the tools themselves are altered in the process. Similarly, communication technologies are not dumb carriers of users' intentions. Technologies are tools with varying capabilities, used by individuals in organizations to define problems, todevelop solutions, and to change their environments (Dhar & Olson, 1989).

Computer-mediated communication technologies in particular are remarkably plastic, Rorschach-like symbols-"cultural objects which different people and groups of people can apprehend with very different descriptions and invest with very different attributes" (Turkle, 1984, p. 320). The social context constrains what tools are available (Markus, 1987; Rice, 1988; Robertson, 1988; Rogers, 1988) how these tools are understood and enacted (Bikson, Eveland, & Gutek, 1989; Fulk et al., 1987; Papa & Tracy, 1988), and how the consequences of their use will be received. In turn, the context is ever-evolving partly as a result of the ways in which these new media are used.

*Beyond the Technological or Organizational Imperative.* The notion of a duality of structure is rarely seen in the literature on organizational media, which has focused instead on either a "technological" or an "organizational" imperative (Markus & Robey. 1988). The technological imperative privileges

media characteristics as determining uses and behavior. The organizational imperative privileges the ability of organizational designers and managers to use media in rational ways, to accomplish specific, clearly defined ends.

Neither approach has received much empirical support. Research adopting the technological imperative has been confronted with the "dual effects hypothesis," which states that communication technologies can have opposite impacts simultaneously and in spite of one another (Mesthene, 1981). For example, the introduction of phones fostered both decentralization (the growth of the suburbs) and centralization (the growth of the skyscraper) at the same time (Pool, Decker, Dizard, Israel, Rubin, & Weinstein, 1981). Research based on the organizational imperative has also been inconclusive. Johansen (1977) reviewed 251 articles in an attempt to understand the match between the nature of organizational communication tasks and various configurations of teleconferencing. While exceptionally comprehensive, the review did not reach any unequivocal conclusions for designers of information systems (Culnan & Markus, 1987).

Hence, neither approach alone gives a true picture of the social nature of technology in organizations. This is not that surprising since, generally speaking, neither deterministic theories of social conformity nor radical theories of individual agency have ever, taken individually, provided adequate explanations of human behavior (Wentworth, 1980). We agree with Markus and Robey (1988) that the study of technologies in organizations is best served by what Pfeffer (1982) called the emergent *perspective* on action in organizations. According to this perspective, "the uses and consequences of information technology emerge unpredictably from complex social interactions" (Markus & Robey, 1988, p. 588). It is these interactions that must be examined as where the ongoing tensions between agency and constraint are worked out. This implies full attention to the pragmatics of media usage in organizations, considering at once the reciprocal relationships among goals, technology, actions, and interactions that constitute the emerging situations (Kling & Scacchi, 1982; Weick, 1984). It is therefore critical that our theories and research methods recognize the emergent structural relationships among individuals, rather than focus exclusively on their attributes.

## Communication Networks and New Media

The purpose of this section is to describe the various theoretical mechanisms by which the social environment shapes media use-and vice versa— focusing specifically on communication networks as an operationalization of the social environment.

### Why Apply Communication Networks to the Study of Technology?

Despite both theoretical and methodological challenges, the concept of communication networks has had a positive and important effect on the way we understand organizations. Based in part on systems theory (Buckley, 1967), communication networks are one attempt to operationalize the ways in which the whole is indeed greater than the sum of its parts (i.e., attributable precisely to the relationships between parts). Network explanations move us into the social realm in understanding human behavior, freeing us from the limitation of considering only microscopic or macroscopic factors. Network theories provide us with a vocabulary for identifying and measuring information flow between people, about a variety of topics, using a variety of media (Monge & Contractor, 1987). A working understanding of the networks that may emerge in any given organization goes a long way toward helping us understand individual and aggregate behavior, and the connection between the two (Monge, 1987; Monge & Eisenberg, 1987).

The major difference between network theory and most other social science perspectives is the emphasis placed on the relationship between two or more objects (or individuals) over the attributes of these objects (Monge & Miller, 1985). The objects or "nodes," in network parlance, may be individuals, groups, organizations, even societies. Network researchers have studied a diverse range of phenomena, including the flow of goods, personnel, money, information, social support, power, and kinship (Knoke & Kuklinski, 1982). Network researchers believe that the natural unit of analysis is not an isolated individual but the relationships between individuals. One prominent student of social support networks, Barry Wellman, criticizes individual research as inevitably concluding that "social behavior is the result of the fact that i.idividuals possess common attributes rather than that they are involved in structured social relationships" (1988, p. 31).

Perhaps the central theoretical concern of network studies, however, is the ways in which patterns of interaction (networks) affect and are affected by individuals' behaviors and cognitions. While it is traditional in the technology literature to speak of antecedents and consequences of technological adoption and usage, when networks are involved, the understanding of these terms must change somewhat. Because communication networks are informal, emergent, and hence always changing, they are continually both antecedents and consequents of behavior with and attitudes toward technology. Hence, while in the following discussions we have been faithful to previous work in its use of the terms "antecedents" and "consequents", our conceptualization sees networks as emergent communication processes that both

affect and reflect many aspects of human behavior, behavior with media included.

The use of network methodologies to study organizational media is not a new idea. Several researchers have proposed using network methods for this purpose (e.g., Fulk, Power, & Schmitz, 1986; Rice, 1988; Rice & Borg-man, 1983; Rogers, 1987; Williams, Rice, & Rogers, 1988). They all claim that networks are well-suited to capture ongoing patterns of communication among a net of individuals interconnected via different media. They note that network methods are desirable for studying technology because they are unobtrusive, they can be automated, they do not neglect weak (i.e., less frequent, but informationally rich) ties, and they provide accurate data.

Others have advocated a network approach because relational-level variables can boost the explained variance in individual-level phenomena. Thus, network methods are proposed as "turbo-chargers" for explaining attribute-level phenomena (e.g., Rogers, 1983; Wellman, 1988). A main consideration of these researchers is the way in which networks shape behaviors and cognitions. Anderson and Jay (1985), for example, examined the adoption of a computerized information system by physicians. They found network variables to be predictive of adoption above and beyond that which was explained by individual attribute variables.

Despite the fact that network methods have been applied to the study of new media, theoretical arguments have been slow in coming (Rogers, 1987). We respond to this criticism by identifying several theoretical mechanisms relating communication networks and media use. Previous usage leads us to organize these unarguably recursive processes as "effects of networks on media attitudes and usage" and "effect of media usage on networks." In each direction we describe these relationships at the individual, dyadic. and group levels.

At the *individual* level, we focus on the role of "key communicators" who have a large number or diverse range of contacts. There are several network metrics that attempt to represent these characteristics. The simplest metric is the size (absolute number of contacts) of a member's network. Other measures frequently used by organizational network researchers include connectedness, centrality, and range (Tichy, 1981). Connectedness (or prominence) refers to the ratio between a member's actual and potential communication links in the network (Alba, 1982). One measure of centrality, betweenness, indicates the extent to which a member communicates with others who do not themselves communicate (Freeman, 1979). These members therefore serve as liaisons between groups. Range (or diversity) is the degree to which a person communicates with heterogeneous groups of others, *along* some salient dimension (Rogers & Kincaid, 1981).

Next, we discuss the relationship between a *dyad's* network characteristics and their similarity in media use and attitudes. The most frequently studied characteristics of a dyad are its strength, multiplexity, and structural equivalence. The strength of a dyad indicates the time spent communicating or frequency of communication. The multiplexity of the dyad refers to the number of types of relationships (in terms of content or media) that exist between the two members. The structural equivalence of a dyad is the extent to which the two members share similar patterns of communication with others in the network (Burt, 1980).

At the *group* level we examine the relationship between the group's network characteristics and media use. The simplest group characteristic, size, refers to the number of members in the network. Other network characteristics include connectedness, heterogeneity, and centralization. A group's connectedness (or density) is the ratio of actual communication links among group members to the number of potential communication links. A group's heterogeneity is the degree to which group members differ on key attributes. A group's centralization refers to the extent to which some members are more central than others.

Finally, very little is known about the relationship between an organization's environment and its adoption and use of a particular medium. Interorganizational networks provide one operationalization of an organization's environment (Aldrich & Whetten, 1981; Lincoln, 1982; Tichy, 1981; Whetten, 1981). Eisenberg et al. (1985) suggest that interorganizational linkages can be classified on the basis of transactional content (material or information) and level of contact (personal, representative, or institutional). In the following discussion, we propose that the recursive relationship between media usage and networks at the individual, dyadic and group levels can be informed by both the examination of intra- and interorganizational networks.

## Effects of *Communication* Networks on Media Attitudes and Usage

Key *Communicators.* Individuals differ in the degree to which they are prominent in a given communication or social network. Those who are well connected can play a key role in shaping the behavior and perceptions of others in the social group (Marsden, 1981). One of the earliest demonstra-

tions of this is work on opinion leadership in the diffusion of innovations— key communicators played a major *role* in shaping the adoption patterns throughout the social system (Parks, 1977; Rogers, 1988). Rogers points out that adoption is facilitated if the administrative head of the group is a key communicator who favors the new medium.

An individual may also serve as an information broker or liaison between individuals who do not communicate with each other. Information brokers are well positioned to maintain the existence of multiple, and possibly conflicting perceptions of the new media. Thus, they can play a key role in helping to define the salience of certain media characteristics and consequently aid (or impede) the diffusion of attitudes and behaviors among diverse groups (Marsden, 1981). In the literature on organizational boundary spanners, Tushman and Scanlan (1981) described effective spanners as both internal and external "stars"; individuals capable of communicating and maintaining the trust of diverse groups can play a key role in the spread of information about new media.

There is considerable research support for the role of prominent communicators in the diffusion and use of new media in the workplace. For example, Rice, Grant, Schmitz, and Torobin (1988) found that prominent individuals were also early adopters of a new information system and facilitated the development of a critical mass of users. Papa and Tracy (1988) report that highly connected individuals in an organization's communication network were also the most productive with the technology, and reported the most positive experiences. There is also some evidence that under certain conditions, the relationship between connectedness and usage is not a simple one. Hiltz (1981) found that scientific researchers of moderate connectedness in their profession were the most frequent users of a computer-mediated conference. "Isolates and sociometric stars do not use the system as much as those with moderate number of professional connections, who seem to have the most motivation to expand their professional networks" (p. 66).

At the interorganizational level, resource dependency theory (Pfeffer & Salancik, 1978) suggests that prominent organizations might influence the adoption patterns of others in their network. According to resource dependency theory, organizational action is in part explained by the conditions and constraints imposed by the environment. Thus, a prominent organization that controls resources sought by other organizations in its environment can play a key role in shaping others' adoption decisions. For example, General Motors recently announced implementation of Machine Automation Protocol (MAP), a communication protocol for their assembly line. Their unilateral announcement forced vendors who made equipment and did most of their business with GM to adopt the communication protocol. In another instance, Chase Manhattan Bank recently became the first major bank to announce an electronic mail gateway that permits 5,000 of its employees to communicate electronically with customers. By giving incentives Chase Manhattan is expecting to encourage adoption of this technology among clients who rely heavily on the bank for financial transactions (Pelton, 1989).

Range or Diversity. In addition to the effect of key communicators, an individual's range of contacts has an impact on his or her attitudes and behaviors toward the new media. Individuals who communicate with a diverse set of people bring new information, alternative perspectives, and often a greater degree of influence to the media perceptions of others in the group. A broad or diverse range of contacts means making novel information available from outside of the focal group (Granovetter, 1973, 1982; Friedkin, 1982). Granovetter's strength of weak ties theory, for example, proposes that people who have diverse, weak ties bring new social resources and information-rich ideas to their networks. In the realm of new media, such individuals provide missing pieces regarding design or application that may facilitate its adoption or redefinition (Rogers, 1988). In interorganizational networks, organizations that scan diverse sectors of the environment are exposed to novel information about the new media and are therefore more likely to introduce these ideas to their networks. In several instances, these ties are formalized by appointing individuals with diverse backgrounds to the corporation's board of directors (Pennings, 1980).

*Dyadic* Level. Social information processing theory proposes that an individual's attitudes about the media are in large part influenced by the attitudes of others in the communication network (Fulk et al., 1987). The process by which individuals are influenced by the attitudes and behaviors of others in their environment is termed social contagion. There are two network models that are used to study social contagion (Burt, 1987; Erickson, 1988). First, the *relational model,* maintains that people will influence (and be influenced by) those with whom they have direct communication contact (Burt, 1980). Accordingly the relational network model predicts that the strength, multiplexity, or symmetry of a dyad's communication will in part determine the extent to which they are also similar in attitudes toward and experience with the media. Rice et al. (1988) found that dyads who communicated frequently with each other about task-related topics were significantly more likely to either both adopt or not adopt an electronic mail system.

The second, *positional model* maintains that individuals will be most influenced by others who share similar status in the organization. People

holding similar status often manifest similar patterns of communication and consequently can be considered "structurally equivalent," even though they may not communicate directly (Burt, 1980). According to this model, people's attitudes toward and behaviors with the new media will be similar to those individuals with whom they are structurally equivalent. This is because structurally equivalent individuals are subject to similar constraints, socialization experiences and organizational expectations. Robertson (1988) found that organizational members who are structurally equivalent were significantly more likely to perceive and utilize information systems in similar ways. Likewise, Walker (1985) reports that, in a computer software firm, members who were structurally equivalent were significantly more likely to share their cognitions about product goals and ways to achieve these goals.

At the interorganizational level, the process by which organizations are influenced by the structure and behavior of other organizations in their environment is termed isomorphism (DiMaggio & Powell, 1983). Isomorphism may result from mimetic, normative, or coercive processes in the interorganizational network. Organizations have difficulty making rational decisions in the face of high uncertainty (March & Simon, 1958). Because there is a high degree of uncertainty surrounding new media in organizations, the decision to adopt may have more to do with interorganizational isomorphic processes than rational intraorganizational criteria such as efficiency. For instance, the "bandwagon effect" observed in the adoption of facsimile machines by organizations suggests that mimetic and normative processes may have influenced the decision more than a rational cost-benefit analysis. Galaskiewicz and Wasserman (1988) have demonstrated the ability of network models to articulate and test for the existence of these isomorphic processes across organizations.

**Group Characteristics.** There has been very limited research studying the impact of group network characteristics on media use. Markus (1987) suggests that the adoption of a particular medium can be explained by theories of collective action (Oliver, Marwell, & Teixeira, 1985). She argues that the adoption of a communication technology by a group requires the existence of a "critical mass" of users. Recent work has shown that a group's network characteristics can be used to predict the prospects of collective action (Bonacich, 1987; Marwell, Oliver, & Prahl, 1988; Oliver & Marwell, 1988). Based on a series of computer simulations, they posit that the density and centralization of a group will be positively related to the likelihood of collective action.

The theory of collective action can be easily extended to the interorganizational realm. A case in point is the aerospace industry. Comprised of only a handful of major manufacturers, this industry is a highly centralized interorganizational network. Recent increase in the volume of subcontracting in the aerospace industry has resulted in increased density of this network. The result is unusually strong pressure to adopt specific kinds of communications media that allow quick communication and the monitoring of subcontracts. For example, in a recent landmark decision by the industry, the 50-member Aerospace Industry Association became the first major U.S. industry consortium to announce a standardized interorganizational electronic mail network (Seghers, Rothfeder, & Hof, 1989).

Hence, we see that individual, dyadic and group level network measures can be used to bring theoretical insight to our understanding of media adoption and use within and across organizations. At the individual level, theories of the diffusion of innovations and resource dependency suggest that prominence in a network influences members' perceptions and use of the new media. At the dyadic level, the relational and positional network models provide alternative mechanisms for understanding social information processing among organizational members. Further, studying the influence of isomorphic processes in interorganizational networks helps explain organizational decisions about new media. At the group level, network characteristics provide ways of testing theories of collective action within and across organizations. The next section focuses on the reverse relationship, how patterns of media use recursively impact communication networks.

### Effects of Media Use on
### Communication Networh Participation

Members' perceptions of and behavior with media are based in large part on the information they receive. As this information must also come through some communication channels, it is itself restricted by previous media choices. It follows that changes in patterns of media use will impact members' positions in their social network, and as a result influence and alter the information they receive. This completes the recursive loop between media attitudes and usage and participation in communication networks. The impact of media use on network participation within and across organizations can be analyzed at the individual, dyadic, and group level.

**Key Communicators.** At the individual level, media use affects network prominence. A number of factors come into play in determining how media use will alter the prominence of individuals. These factors fall into three general categories. Prominence in a network is influenced by: (a) individuals' access to media; (b) individuals' ability to cope with the uncertainty associ-

ated with media; and (c) individuals' ability to accentuate their positive-affect cues and mask their negative-affect via these media. These are described in the next three paragraphs.

Several studies have documented how access to media has influenced the prominence of certain individuals in the system (e.g., Leduc, 1979; Rice & Case, 1983; Sproull & Kiesler, 1986). In general, these studies indicate that access to superiors in an organization via technologically mediated channels prompts individuals to dramatically increase their communication. Consequently, in some organizations the implementation of electronic mail has made senior management more prominent. In some cases the increase in prominence for those at the top of the hierarchy undermines the prominence of intermediaries in the hierarchy (Fulk & Dutton, 1985).

In addition to access, individuals' ability to cope with the uncertainty of various media also influence their position in the network. Individuals who are knowledgeable about a medium tend to rise to immediate prominence within the network. Thus, internal consultants are typically very popular throughout adoption and beyond. Aydin's (1989) study of student health services at a university shows that the people who knew most about the system and were formally responsible for helping users become proficient were also the most prominent in the accompanying communication networks. In his study of the Electronic Information Exchange System (EIES), Rice (1982) found that user consultants and personnel monitoring the system emerged as information brokers in the communication network.

Finally, individuals' ability to highlight or shield their positive and negative affect cues influence their prominence in a network. Olgren and Parker (1983) have documented the prevalence of a "Hollywood Syndrome" in video-conferences leading to the emergence of new stars who put on "a slick performance . . . for effect rather than substance" (p. 239). Likewise, Kerr and Hiltz (1982) review several studies where computer-conferencing was especially helpful in expanding opportunity structures for the handicapped. They point out that "the suppression of nonverbal cues means they interact more equally" (p. 138). In addition, researchers have proposed that network involvement is related to organizational commitment (Eisenberg, Monge, & Miller, 1983), turnover (Krackhardt & Porter, 1986), leadership (McElroy & Schrader, 1986), and the socialization process (Jablin & Krone, 1987; Sherman, Smith & Mansfield, 1986). By virtue of its direct influence on the organization's communication network, media usage has the potential to indirectly affect several other key employee reactions.

The effects of media usage can also be observed in interorganizational networks. Organizations often adopt new media to gain a competitive advan-

tage. A well-known example of this strategy was the introduction of Sabre, a computerized airline reservation system developed by American Airlines (Williams, Rice, & Rogers, 1988). In the early 1980s, American Airlines offered travel agents a free desktop terminal and access to the Sabre reservation system. The new system was very attractive to agents who were frustrated with the inefficiency of the telephone. The rapid adoption of the Sabre system by travel agents boosted American Airlines' betweenness (or centrality) among organizations in the travel industry. Further, American Airlines had easier access to fare and schedule information from the other airlines, which was useful in their own scheduling and pricing to make their flights more competitive.

*Range* or Diversify. Media use can also alter the range and diversity of an individual's communication network. This diversity results from the new media's potential to span geographical and temporal boundaries. Fulk, Power, and Schmitz (1986) reviewed several studies where introduction of technologically-mediated communication served to increase the diversity of communication relationships by linking diverse groups (e.g., Johansen & DeGrasse, 1979).

The use of the media can also have a major impact on the diversity of links across organizations (Huber, 1984; Leduc, 1979). The proliferation of broadcast media such as public electronic bulletin boards and computer conference systems potentially increases the diversity of "weak" interorganizational ties. These "weak" ties can help organizations scan their environments (Huber, 1982) or assist disgruntled employees in seeking new jobs (Granovetter, 1973). In addition, the boom in one-to-one electronic mail systems increases the diversity of "strong" ties across organizations. These ties can be especially influential in creating "invisible colleges" that connect researchers dispersed geographically but who share a common intellectual interest (Allen, 1977; Crane, 1969; Lievrouw, Rogers, Lowe, & Nadel, 1987).

*Dyadic Level.* Similarities in perceptions and use of the media can result in an increase in dyadic communication. This argument is based on findings that mediated communication reinforces rather than substitutes for face-to-face communication. For instance, studies reviewed by Kraemer (1982) show that organizational teleconferencing *increased* overall communication rather than simply substituting for face-to-face communication. In a longitudinal study, Eveland and Bikson (1988) found that pairs of individuals who had access to electronic mail (in addition to face-to-face contact), interacted more frequently with each other than those who only communicated in person. Further, the adoption of new media in addition to, rather than as a replacement for existing media increases the multiplexity of the dyad.

Studies based on Berger and Calabrese's (1975) uncertainty reduction theory indicate that increased multiplexity helps reduce uncertainty and thus facilitates organizational innovation (Albrecht & Ropp, 1984; Bach, 1989).

Likewise, the adoption of a new medium for interorganizational communication normally serves to increase rather than replace the communication via existing media. For instance, analysts in the aerospace industry predict that the introduction of an industry-wide electronic mail system (discussed earlier) is likely to increase the total amount of interorganizational communication by about 20% (Seghers, Rothfeder, & Hof, 1989). An increase in interorganizational communication can have diverse implications. Monge (1987) points out that more communication can facilitate coordination and cooperation (Van de Ven & Walker, 1981), or competition and control (Aldrich & Wbetten, 1981), or both (Zeitz, 1980).

Group *Level.* At the group level, media use can alter the structure of networks by changing existing boundaries. In general, network studies provide little or no theoretical rationale for their choice of system boundaries. Most organizational network studies specify the limits of the formal organization as the boundary of their network. Thus, a boundary spanner has been traditionally defined as one who communicates with individuals outside of the formal organization (Adams, 1976; 1980; Katz & Kahn, 1978). The introduction of new media in and across organizations makes the specification of organizational boundaries even more difficult.

Further, the use of new communication technologies in organizations can alter access and control over the "means of production" and pose new political challenges that existing structures may not be able to handle (Zuboff, 1988). Burkhardt and Brass (1989) note that the uncertainty accompanying the diffusion of technology (and the new capabilities of the technology itself) can undermine the existing power structure and therefore alter the networks in organizations. Further, the use of certain technologies can result in the reconfiguration of the network. In her study of a major hospital, Aydin (1989) reported that the implementation of a computer information system disturbed traditional status distinctions between nurses, doctors, and pharmacists, resulting in considerable short- and long-term changes in communication patterns.

## Organizational Communication Networks and the Structuring of Technology

Having reviewed the current literature on the new media and communication networks in organizations we now return to articulating ways in which networks structure the uses of new media in organizations. The above review indicates that previous work has for the most part taken a limited view of how network structure and individuals' positions in a network might affect their attitudes and utilization of the media,

Returning to the theme of an emergent perspective on organizational action, the "effects" of technology are not always direct, anticipated, or desirable (Rogers, 1983; Kiesler, 1986). In the case of the telephone, Pool et al. (1981) document how society appropriated only a handful of the hundreds of applications that could have been implemented. Clearly, characteristics of the media interact with cultural and social norms to constitute the nature of the implementation.

In addition to reflecting existing social norms, it is important to recognize that employees continually use the media to create new, and to modify existing, norms. Johnson and Rice (1987) document the norms that evolved about the use of word-processing. Watson et al. (1988) identify the gradual emergence of norms for reaching group consensus using group decision support systems. Steinfield (in press) reports that users of a recently implemented electronic mail system used the medium to censure certain forms of communication (such as flaming). Steinfield also describes how the medium was used to structure users' perceptions of "message discipline" including the frequency of checking electronic mail, and the acceptable turnaround time for responses.

We expect that perceptions and use of the media are the outcome of an interplay among actors, context and technology. This interplay is an adaptive process that allows for widely divergent outcomes in different settings. For instance, Barley (1986) described how the introduction of computerized tomography (CT scanners) occasioned similar dynamics but lead to very different structural outcomes in two radiology units.

The idea of studying technology in organizations from an emergent perspective is a novel and, we believe, useful approach. More specifically we believe that an emergent network perspective affords a unique set of conceptual and methodological tools to examine the restructuring of communication technologies in the workplace.

First, the emergent network perspective provides an opportunity to examine how microlevel appropriation processes impact macrolevel adoption by the group. It therefore highlights the potential for mutual influence between human agency and collective action. Thus, the network approach can be made to reflect our assumption about the existence of an autonomy-interdependence dialectic in organizational communication.

Second, using this perspective, we can study communication technologies broadly rather than restrict ourselves to the study of specific goals or media. **A** network perspective is well-suited to the systemic study of multiplex networks (i.e., with multiple goals and media). Hence, we see that an emergent networks perspective, unlike the media characteristics perspective, can be aligned with our assumption that communication involves multiple goals that cannot be separated from one another.

Third, and finally, the emergent network perspective provides specific ways of examining how the appropriation of technology influences the individual. These characteristics set it apart from the other approaches to the emergent perspective discussed above.

## A Hypothetical Scenario

Our discussion so far of the emergent network perspective has been largely abstract and theoretical but with important practical implications. In order to exemplify some of the practical implications we invite you to consider a hypothetical scenario. The scenario, describing the introduction of a voice-mail system in a manufacturing organization, permits us to explicate the recursive processes relating communication networks and media use.

The idea of using a voice mail system was initially championed by the chief executive officer. Voice mail systems were not widely used in the city or in this industry, but the CEO had heard the virtues of such a system extolled at a trade convention. Changes in the organization's environment were forcing the CEO to spend an increasing amount of time away from headquarters. Hence, the CEO proposed the use of voice mail as a "personal," prompt, and accurate way for organizational members to stay abreast of events in the organization and its environment. In other words, the idea of adopting the technology came from one of the CEO's "weak" ties at a convention.

To test the idea, the voice mail system was first introduced as a service for top management. The pilot project was an instant success. The voice mail system was quickly adopted and widely used. Clearly, none of the members of top management could risk being excluded from a system that (a) had the blessings of the CEO (a key communicator who had diverse links both inside and outside the organization), and (b) was being used by others with similar status (i.e., were structurally equivalent).

The success of the pilot project reinforced the CEO's commitment to the idea. The system would provide a personal way to quickly and accurately monitor events throughout the organization. It would also provide an effi-

cient way of instantaneously disseminating information via broadcast messages to several people on a "mailing list". Citing these reasons, the CEO announced the introduction of a voice mail system for the entire organization.

The CEO's rationale made employees more sensitive to certain aspects of communication in the company. The CEO made clear that oral communication was most desirable because it was "personal" (as compared to impersonal memos) and that a premium was placed on speed and accuracy of communication. The members of the organization used these and other criteria to evaluate the voice mail system.

The adoption of the voice mail system by key communicators in top management provided an incentive for others in the organization to follow suit. However, within a short period of time, different constituencies used the system with varying regularity and for diverse purposes. As expected, the system was used by sales representatives who were geographically dispersed. The adoption of the new medium reduced the feeling of isolation among some of these employees. The system was also used extensively by workers on the assembly line. Contrary to expectations, however, they did not use the system to provide reports to superiors. In fact, they only used voice mail to send messages to superiors when they wanted to *avoid* direct contact! They redefined the functionality of voice mail primarily to communicate problems and seek solutions from mechanics on other shifts.

Also unforeseen by the CEO, the voice mail system faced resistance from two other departments. Objections were raised privately and publicly by accountants and engineers. Accountants had problems with the system because it deviated from the traditional ways they were used to communicating using text and numbers. Engineers also failed to see the value of the system, as so much of their communication depended on visual aids. Consequently, the adoption and use of this new medium had differential impacts on the communication networks *within* the organization. Within sales, the introduction of the system resulted in *increased* communication (and cohesiveness) across geographic and formal status divisions. Because of the resistance, however, there was little change in the communication networks either within or between the accounting and engineering departments.

The use of voice mail also influenced communication networks *across* departments. Employees in sales used the system not only to improve coordination within their department, but also to forge closer links with senior management. Further, and much to the chagrin of the accounting department, employees in sales began to send the accountants voice mail

messages in lieu of "putting things in **writing."The** networks in the accounting and engineering departments remained largely inwardly focused and unchanged resulting in their increased isolation in inter-departmental communication networks. More significant was a felt *decrease* by both departments in influence over senior management decision-making. Their text and visual-based proposals were being discounted by the CEO and senior management who began to rely more heavily on the more timely, oral arguments presented by other departments via voice mail. Clearly, the introduction of voice mail was, for separate reasons, undermining the position of the accounting and engineering departments in the organization's communication networks.

To reassert their declining political position, the accounting and engineering departments used different strategies. The accounting department embarked on a campaign to change employee perceptions of the voice mail system. They used the system itself to "broadcast" messages pointing to the steep rise in costs associated with the use of the voice mail. They also forwarded to senior managers examples of voice messages that they argued did not warrant the cost of messaging. These actions generated a debate on the cost-effectiveness of voice mail. In addition, the fact that private messages were "forwarded" (as illustrations) raised questions of privacy that had not surfaced before. These changes in perceptions of voice mail led to the emergence of new norms regarding its usage. Employees cut back on their use of voice mail, avoiding communication of a confidential or sensitive nature. Further, in response to some of the issues raised by the accounting department, the management restricted access of the voice-mail system for certain employees.

The engineering department addressed their growing isolation differently. They capitalized on the euphoria surrounding new communication technologies in the organization to propose the purchase of a broadband local area network (LAN). This system would allow the transmission of high-resolution visual communication within the organization's main location. The information could be accessed via terminals placed on managers'desks. The top management, who viewed this proposal as reinforcing their information-gathering and decision-support capabilities, approved the purchase. Thus, engineering now had direct access to management using a channel that was most appropriate to support their communication requirements. In addition, the fact that top management had invested heavily in this new technology persuaded them to heed more carefully the advice they received via this medium.

To summarize, this scenario provides several examples of the recursive interplay between networks and media use. It was one of the CEO's "weak" inter-organizational ties that suggested the idea of using voice mail. The prominence of the CEO among the top management's communication network contributed to the success of the pilot test. Subsequently, the rationale and adoption by top management contributed to the initial perception and use of the system by various departments in the organization. Over time, however, the system was appropriated differently by individual departments. These differences in turn resulted in changes in the communication networks within and across departments, In particular, it led to the relative isolation of the accounting and engineering departments. Their isolation was for different reasons and they used different strategies to address these problems. These strategies resulted in redefinition of the norms surrounding use of the voice mail system, and the adoption of a new visual communication medium. These changes set the stage for yet another reconfiguration of the emergent communication network.

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