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# Chapter 7

# New Patterns of Social Structure in an Information Society

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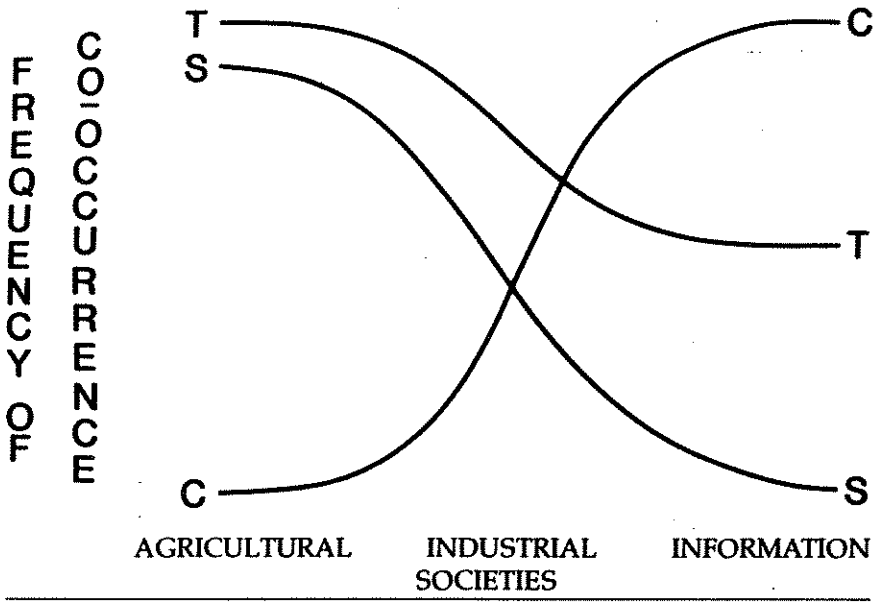
Groups, organizations, and societies are made up of patterns of relations. These patterns are often called *networks*, and are one form of indicator of social structure. Social structure in general is a primary concern of social science as well as of policymakers. Because computer-based communication systems are providing new environments for social structure, one particularly significant aspect of information societies is the potential for increased size and diversity of social networks.

Becoming part of social networks, maintaining them, expanding them, and exchanging information through them has always been limited by the temporal and spatial constraints of available communication channels—face-to-face meetings, telephone calls, letters, academic journals, travel, etc. However, computer conferencing, electronic mail, electronic publishing, community computer-based bulletin boards, and online databases have created the potential for people to communicate with others in different locations, whether the participants are using the system at the same time or not, whether the participants are known to each other or not, and even to communicate interactively with many participants at once (Dordick, Bradley, & Nanus, 1981; Hiltz & Turoff, 1978; Kerr & Hiltz, 1982; Rice, 1980b; Rice & Associates, 1984).

Information technologies extend the capabilities of individuals, organizations, or populations precisely because they loosen constraints, such as matter and energy, which are barriers for more traditional media. For example, books must in some way be constrained by material limits—such as paperstock prices, delivery mechanisms, and cyclical flows such as library circulation procedures. Information directly en-




NOTE: T = temporal co-occurrence
S = spatial co-occurrence
C = communication interaction

**Figure 1. Suggested trends in the required frequency of temporal, spatial and communication co-occurrence of network members in three types of society.**

tered into a computer-based communication system, however, can be retrieved by many users at different locations without loss of the original information and with no need to "return" it. While there are the costs of electrical energy to run computers, or access and service charges to recover the information provider's expenses, the *information* is not theoretically constrained by material or energy resources.

These and related resource constraints have taken different prominence throughout history. Figure 1 presents an hypothesized relationship between the needs for temporal, physical communication interaction in agricultural, industrial, and informational societies.[1] For example, with the rise of the printed book, postal service and newspapers, there was less need for members of social networks to be in the same place at the same time. However, media such as the telephone, radio and early television still required participants to be communicating at the same time. With computer-based technologies, members of a common social structure can choose to have greater or less temporal, spatial and communicative co-occurrence as they desire.

[1] The role of new communication technologies in overcoming traditional constraints to communication is discussed in greater detail by Rice and Associates (1984) and Williams, Rice, and Dordick (1985), while specific impacts are discussed by Kling (1980) and Rice (1980a).



The purpose of this chapter is to attempt to identify some of the functions and constraints of computer-based communication environments in creating, maintaining, removing, and destroying group bonds and boundaries. The approach taken here considers how social exchange relations, human information processing limits, and environmental constraints jointly influence the development and stratification of groups in information environments.

These elements are considered from an ecological perspective. Hawley (1973) refers to human ecology as the study of "the form or pattern of human sustenance relations, the process of development of such patterns and the factors that affect their development." Human ecology is concerned with "individuals and groups seeking position in a developing system of relationships." Organizational ecology, as analyzed by McKelvey and Aldrich (1983), Hannan and Freeman (1977), and others, considers organizations from this theoretical perspective.

The theory argues, essentially, that variation occurs in an environment and/or a population within it (such as increased competition for resources); that the environment and/or other populations respond to this variation by selecting for certain behaviors (such as effective use of the information); and that these behaviors are then retained (successful users of information "survive"). Ecological studies are thus interested in the development of relations, but also in the surrounding environment, which consists of material, informational, and technological constraints. The following discussion focuses primarily on informational and technological constraints, at the individual, group or organizational, and societal levels of analysis.

## *INDIVIDUAL COMMUNICATION PATTERNS WITHIN GROUPS*

In small group networks, individuals are concerned largely with informational and affective relations, and less with strictly material ones. Two well-studied individual attributes seem to influence one's communication behavior at this individual-within-group level: sociability and drive for status.

The first attribute—*sociability*—is considered here as the degree to which one tends to communicate with others. Two indicators of this tendency are identifiable and measurable personality traits. The first is

*response latency*—how long it takes one to respond to an opportunity to communicate in an interaction—while the second is *response duration*—how long one tends to talk during an interaction. Research shows that latency correlates .6, and duration even higher, with one's level of participation in future communication interactions, while other traits such as I.Q. correlate only around .1 (Hiltz & Turoff, 1978; Koomen & Sagel, 1977). People with short response latency and high response duration will communicate earlier and longer; they are more "sociable," measured simply.

The second attribute is a *drive for status*. Drive for status here is the degree to which one responds to status stimuli, the opportunity to gain, or be associated with, higher levels of social ranking. The more one responds to such status stimuli, the more one tends to interact. High individual sociometric status is commonly measured as receiving a large proportion of a group's communication links, and as requiring only a small number of linkages in order to have one's communication reach the rest of the group (see Rogers & Kincaid, 1981).

Both Blau (1963, 1977) and Homans (1961) argue that information, particularly work-related information in a bureaucracy, is a *resource* exchanged for services and other goods—including status. Status is a medium of exchange particularly when a person seeks information from a more experienced or higher-status person, and has little else of value to bargain with. The superior receives information, more sociometric links, and even higher status (up to a point); the subordinate receives both the indirect status of having communicated with the superior, and some resources necessary to accomplish the task. Status and group resources, in the form of reduced sociometric distance and access to information, are competed for by individuals according to their sociability and drive for status (see Burt, 1978). There are, of course, constraints on this competition. *Physical* and *formal distance* play a part in constraining communications. Greater physical distances simply makes it harder or less likely that people will communicate, while formal distance (organizational, kinship, authority) places sanctions against certain interactions.

*Access* to communication media may be constrained. Outside phone lines may be available only to upper-level organizational members, while typewriters and word processors may not be available to those same people. Potential communication recipients may have procedural filters or gatekeepers, such as a personal secretary, that prevent all but privileged access.

People also have an *upper limit* on the amount of information they can process at one time, and therefore on the number of others with whom they can maintain frequent contacts. As Killworth and Bernard



(1974 p. 348) write, "Perception, or intuition about one's place in the structure (for a given content, in a closed group) is limited to one's own communicants (i.e., about 7 + or −2 people; a chunk in Miller (1956) and Simon's (1974) terminology) and about 70 percent of one's secondary communicants." Because individuals must allocate their commitments within various groups and elsewhere, they also have a limit on how much time, energy, and information they can commit to any particular group.

Computer-based communication systems, like many other media, do not transmit all the communication codes which humans can perceive in face-to-face interaction (see Short, Williams, & Christie, 1976). Many of the *markers* normally available to individuals and group members on which judgements of status are made are missing in an electronic environment. Additionally, the ability of users to enter information into the system at any time tends to *reduce* the impact of differences in members' sociability. Thus, *social differentiation* based upon natural variance in the effect of status markings and of sociability is likely to decrease in computer-based networks, resulting in greater equality of communication participation. Due to this increased equality, group decisions and consensus may take longer, while the quality of the group's decision may improve. Exactly such results have been found by Hiltz and Turoff (1978) and Rice and Associates (1984, chapter 6). However, research shows that computer-mediated communication is not completely short of socio-emotional content (Rice & Love, 1987). This is also not to say that known or perceived status of other group members does not play any role in electronic communication systems. Hiltz, in reporting on analyses of computer-conferencing communication patterns, writes, "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." Apparently, "what matters to the individual is how many other group members available to communicate with have relatively high professional status" (Hiltz, 1981, p. 66; see also Hiltz, 1983).

The point of the preceding discussion is that it appears that (a) if individuals compete for group resources in the form of information and links with high-status others, (b) if they require some minimum contacts to survive in an information environment, and (c) if individuals must operate under constraints in the amount of information and links they can process, then individual communication behavior will favor *reciprocated relations* in large groups, because it is the only way individuals can protect themselves against "free-riders." Free-riders, in ecological terms, are individuals who take advantage of community (group) rules for providing resources, without paying any costs for this ex-

change. Indeed, the best-fitting model of communication patterns from two years' data of a large-scale (N=800) computer conferencing system supported this hypothesis of reciprocal relations (Rice, 1982). In small groups, there is less chance of free-riding, as most individuals are interconnected in balanced structures and there are sanctions against deviant behavior. In a large group or system (particularly computer networks where members can easily come and go as discussed below), where an individual simply cannot interconnect with all other members, providing information or status without eventual reciprocation is, over time, a lost resource. Efforts at communication, if unreciprocated, will cease. Another implication of these exchange patterns is that people should prefer to operate in small groups as opposed to large groups, *unless* they can freely choose their partners in the large groups. So the size of one's social network should increase with use of new communication systems. Obviously, such patterns are heavily dependent on the content and function of the group's particular communications.

In computer-based communication networks, then, individuals are freer to search for contacts, because they are less constrained by physical, temporal, and status components of most communication channels. However, they are confronted with even greater demands on their information processing capabilities, because there are so many potential contacts on a system. Therefore, individuals must compete for information resources in a less structured social system but with greater attention to the value of interactions in the system.

## *GROUP NETWORKS*

At the level of the group or a small organization, individual attributes and constraints come under the influence of, and create, group norms and constraints.

As the individual has upper limits of information processing capability, a group also has upper limits. The larger the number of members, the more information exchanged and linkages maintained, and, thus, the greater the organizing capacity the group has. Also, the larger the number of members, the larger the number of roles at equilibrium (Wilson & Bossert, 1971), because the division of labor increases. But with this increase in size and role structure come two problems.

The first problem is simply a *limit* to the amount of internal activity which can be handled. The total number of possible two-way communications links increases geometrically (n(n-1)) as the number (n) of units increases. As this number grows large, individuals become unable to maintain reciprocal relations, and pathways for information transmission within the group become overloaded. Very soon after the number



of nodes in a group is greater than six, the classic "laws" of small group structure break down (Davis, 1969).

The second problem is the increasing need for *integration* among differentiated group subcomponents as a group increases in size and complexity (Galbraith, 1977; Lawrence & Lorsch, 1967). One form this integration takes is *normative density*, or the convergence of each individual's norms around the group norm. The early small group studies and related research showed that group norms led to conformity by its members (for example, see Asch, 1951). Under conditions of information overload (when information processing limits are exceeded), group members cease making analytical decisions and fall back upon prior "retained" rules for reducing equivocality, upon documented procedures which may not even be appropriate, or upon group codes, rituals and norms (Schroder, Driver, & Streufert 1967; Weick, 1969). Berger, Conner, and Fisek (1974) also document how retained expectations can become self-fulfilling or constraining influences on group judgements. Although these "retained" norms, or the normative density, may be inappropriate for the problem at hand, this kind of stability allows many groups to survive moderate changes in their environments.

As a group becomes too large, or becomes unintegrated in its role structure, the group becomes too *loosely coupled*, and differences in perceptions, motives, and norm adherence increase (Aldrich, 1979). Thus, groups need integrating roles to maintain stable and productive structures. If a group's motivation is a given task or goal, then, initially, a leader is required, and emerges, to provide structure to information flows. The leader typically gains status as well as access to information in this enterprise. The small group research finds that "persons holding relatively central positions tended to evolve as decision-makers and were generally judged to be leaders by the other group members. Moreover, persons in central positions, as compared to those in peripheral positions, tended to send more messages, to solve tasks more quickly, to make fewer errors, and to [be] better satisfied with group and personal efforts" (Davis, 1969, p. 96).

Aldrich (1979) explains how, between sets of groups with at least partially differentiated resources, the establishment of *liaisons* is an environmentally less costly solution to the problem of interdependence and transferral. A liaison is an individual who connects two or more groups but is not a member of any of those groups. The liaison role may, of course, be played by individuals, groups, organizations or any node that mediates the interaction of other nodes. In exchange for dependency, the external groups reduce their need to fully interconnect with all other groups, and reduce their vulnerability to environmental changes.

Killworth (1974) argues that the liaison role (as well as intransitivity)

is essential to the healthy functioning of groups. Amir (1979) would agree, too, in the need for intransitivity and liaisons, because, within a group, stable status ranking promotes individual survivability by preventing direct competition for resources. In other words, some kinds of unreciprocity and structural differentiation (such as network roles) enhance a group's stability, depending on which resources are exchanged.

However, *inefficient* occupants of these roles, or roles *inappropriate* to the needs of a group as it functions in its environment, constrain internal structure. Constraints may be caused by information or other resources that are poorly extracted from the environment or inequitably exchanged (this may be due to noise in the system, error, misinterpretation, conscious distortion or omission, unequal distribution due to status motivations, etc.). Serious inefficiencies and inequalities lead to simplified structure, disintegration, and extinction of the group or its integrating system.

*Role occupancy* by individuals within groups, and of groups within a system, is influenced by an interaction among resource availability, individual attributes (sociability and drive for status), imposed communication structure, and the nature of the system's environment. Thus, communication roles are positions in information networks (Burt, 1978) and expectations of norm and resource distribution (White, Boorman, & Breiger, 1976). Groups with unadaptive role distributions and internal structure are selected out by variations in the environment.

In an information society, this means that there is *competition* for access to, control and sale of, and rewards from, information, leading to stratification between the information-rich and the information-poor. As niche theory expects, leaders and liaisons establishing themselves in such integrating roles early on have an *intitial advantage* as brokers of resources (status, information, material). Thus, those who establish communication with others early on occupy this role or niche, and will have an advantage in maintaining this role, particularly in larger groups. The study by Rice (1982) showed that task-free groups were early on able to capture information-rich roles in the conferencing system, while task-oriented groups, which were less free to explore or respond to the information environment, quickly became and remained isolates.

## *COMMUNICATION NETWORKS AS SOCIAL STRUCTURES*

One of the great hopes of computer-conferencing proponents is that the ability to index and find system members by interests, background, or key-words in members' public directories will bring together many



currently unconnected individuals and support a very diverse system comprising new subcultures, and perhaps a new society (Hiltz & Turoff, 1978, Hiltz, 1983). But increasing the number of connections does two things: it tends to increase system *instability* and tends to *homogenize* previously unconnected groupings (Hannan, 1979; Emery, 1969; Aldrich, 1979).

Thus there is a clear need for individuals and groups who are well trained as *information brokers*, a specific application of the liaison role. Such a role in an information environment serves to reduce the amount of searching necessary by new members of the environment, and to increase the effectiveness of those already familiar with it. Indeed, Strassman (1980) argues that a transformation of organizational networks to structures with strategically placed liaisons is crucial to the survival of information-based work settings.

Aldrich (1979) provides a veritable laundry list of variables affecting the stability of networks: environmental shifts, variation in the member population, members' need for differing distributions of resources, reciprocity of links, multiplexity of relations and channels, probability of the absence of any particular link, impact of transmission failure in links, etc. And Duncan (1964) discusses kinds of change in human structures (expansion, conversion, and contraction) and mobility between structures (migration, nomadism, and emigration). Given so many dynamic forces potentially operating in a system of communicating groups, it is no wonder that Aldrich claims that system instability is the norm. A system will "degrade" unless it is maintained by external energy through synergistic transformation, or the total material and complexity involved is reduced. The study by Rice (1982) found that sustained occupation of information-rich roles requires constant above-average levels of information transmission and reception; the overall network was fundamentally entropic in that the transition probabilities from one information role to another information role led groups over time toward the isolate role. Rice and Barnett (1986) extended this analysis by showing how the system as a whole was sensitive to changes in group activity levels, while the main information attributes were quite stable.

*Retention* of information is one of the critical processes (along with initial variation of the organization to match the environment, and later selection of inputs from the organization) in the stability and survival of organizations (Weick, 1969). With the ability to process new information, and with more flexible structures possible with new communication systems, organizational retention is likely to be less rigid. That is, organizations are less likely to be constrained by procedures and decision rules distilled from the reduction of uncertain information from

the environment at an earlier time. Such organizations are more likely to survive in a quickly changing environment than those with rigid structures and lengthy retention schedules. New information and organizational capacity for processing information can increase with the use of computer-based communication systems.

Computer conferencing and similar technologies could alter the *adaptability* of an organizational group, with consequences for decision-making, communication structure, and, perhaps, survival by virtue of various retrieval and processing capabilities. For example, Kaplan and Miller (1977) found that differential memory (and perceptions) of group members exposed to identical information led to considerable variety in information shared in later discussion sessions (with fewer facts, and fewer kinds of facts, recalled from earlier sessions), and, thus, to later judgement shifts. A conference system could record and provide these past communications equally and immediately to prevent ill-informed or biased judgement shifts.

The ability to form *connections* with temporally and spatially dispersed others, without aid of prior shared norms, social background, age, or experiences, leads us naturally to question and reformulate our notion of "group." Boissevain (1968) identified this need early on, though his concern was with personal and anthropological networks. He concluded that analysis can profitably look at social networks as a continuum, from interacting individuals through ego-centered networks, quasi-groups, social groups, organizations, and society. The implication here is that our individual behaviors (and research concepts) that are based on clear-cut distinctions between "individuals," "groups," and "communities" will begin to mislead us in every day activities (as well as in research focus). Further, groups may form based only upon common interests, thus ignoring other important aspects of social structure.

For example, we cannot deny the role of political and material wealth in the creation and maintenance of social stratification. However, *information wealth*—increased connectivity and control over the production, rent, flow, and retrieval of information—will interact with material wealth to create different kinds of social stratification. For example, Table 1 suggests new categories couched in terms familiar to agricultural and industrial societies.

One aspect of this interaction has to do with increased information wealth—specifically, personal contacts—as a product of social and material wealth. Greater social wealth and status leads to increased likelihood of shared traditions and social means, attendance at certain schools, access to certain job categories. These situations lead to increased density within the social category and greater cohesion, and



TABLE 1. SOCIAL ROLES IN AN INFORMATION ECONOMY.

| MATERIAL WEALTH | INFORMATION WEALTH | |
|---|---|---|
| | High | Low |
| High | Technocrats: Executives, political and corporate power | Knights: Inherited wealth, static but high-status networks |
| Low | Prophets: Consultants, educators, hackers | Serfs: Underclass, economic isolates |

thus increased attractiveness as objects of contact. That is, they are seen as "leaders" or "information carriers" and are valued as contacts (Rice, 1982; Rytina & Morgan, 1982).

A minority group (such as technocracts) can develop high cohesion and considerable contacts with the majority and other minorities, becoming a dominant minority. Prophets may have considerable information wealth, but will not be as attractive as potential contacts due to their lack of cohesion and low internal density. Their ability to focus on specific content and specific contacts, because of the loosening of temporal and spatial constraints, prevents the development of contextual and institutional norms. Associating primarily through computer-based communication networks, and primarily on the basis of shared interests in shifting information topics, these individuals may be far less likely to build up other kinds of social, affiliational, or community bonds. Descriptions of new social structures emanating from work styles in Silicon Valley emphasize this decreased contact with politics, community, and church (Rogers & Larsen, 1984). Until information wealth is converted into social and material wealth, or until it is widely valued as a central social resource itself, the prophets will continue to rule the intellectual deserts and oases where information travellers pass by, but will not lead information-based migrants into the promised material land of the technocrats and knights.

## *SUMMARY*

As new means for creating, storing, distributing, retrieving, and using information are facilitated by new communication technologies, information societies will begin to differ from more traditional societies. This fact is, of course, nothing new, as societies constantly change, either by adaptation or upheaval. But we can begin to understand some of

the social aspects of information societies by considering how social networks are constrained or aided by these technologies.

This chapter has suggested that computer-based communication networks loosen some constraints of prior media. These constraints include temporal, energy, material, distributional, and geographical limitations. New communication systems overcome these constraints by allowing a variety of interactions across different places, times, boundaries, audiences, and channels. Along with reduced domination by individuals of high sociability or of high status, these abilities increase the co-occurrence of communication activities. This emphasis is in contrast to the prominence of temporal and spatial co-occurrences necessary in previous societies.

However, the new media create or emphasize new constraints of their own. These include increased demand on individuals' capacities for maintaining their networks, their need to compete for information resources with reciprocal exchanges, and potential dominance by the information-rich. Groups, too, may enjoy potential benefits of new media, such as increased responsiveness to their surroundings, but may sacrifice some consensus and run the risk of instability due to membership size and mobility. Groups will have to learn when to support or defer to liaisons who scan the environment for them.

Organizations and societies will be able to process more and better information (this includes increased filtering and gatekeeping), and new organizations and sub-cultures will rise easily from shared interests expressed online. Yet both may also have to manage increased complexity and instability in these social structures, as the wide set of traditional bonds and obligations will be absent.

Indeed, some of the most prominent new groups may be ephemeral in nature, and never gain the internal cohesion necessary for them to become attractive resources for other groups. In the end, the pervasiveness of computer-based social networks may reduce the role and presence of enduring social structures. Paradoxically, in the environment of a nonmaterial, unconstrained information society, only very instrumental relations may persist.

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