Social Network Analysis For Organizations

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This article introduces the social network approach — its origins, key concepts, and methods. We argue for its use in organizational settings and apply the network approach in a comparative analysis of two organizations.

Organizations can be viewed as social groupings with relatively stable patterns of interaction over time [Katz & Kahn, 1966; Weick, 1969]. Such a model of organizing, if it is to move beyond the metaphorical stage, requires a coherent framework and accompanying methods of analysis that are capable of capturing both prescribed and emergent processes. The social network perspective is an example of a theoretical framework that has developed to the point of guiding data collection as well as data analysis. With current methods, network data can be organized and examined to capture significant organizational processes at different levels of analysis. The social network perspective is thus capable of linking the micro and macro approaches to organization behavior [Crozier, 1972].

In defining social networks we start with Mitchell's view: "a specific set of linkages among a defined set of persons, with the additional property that the characteristics of these linkages as a whole may be used to interpret the social behavior of the persons involved" [1969, p. 2].

In addition, the social network approach views organizations in society as a system of objects (e.g. people, groups, organizations) joined by a variety of relationships. Not all pairs of objects are directly joined, and some are joined by multiple relationships. Network analysis is concerned with the structure and patterning of these relationships and seeks to identify both their causes and consequences. The multilevel applicability of the network perspective suggests that it can add insight to several content areas. At the organizational level, communication studies [Porter & Roberts, 1976; Tushman, 1977], and work on power and political processes [Pettigrew, 1972; Zald, 1970] could benefit from a network formulation. Similarly, the evolving work on careers [Granovetter, 1974] and socialization [Edstrom & Galbraith, 1977] could be refined by investigating the evolving networks of information and influence that individuals are embedded in. At the interorganizational level, the web of direct and indirect relationships between organizations could be made more explicit by a network approach [Aldrich, 1977; Evan, 1966; Pennings, 1978].

The Social Network Framework

Since the development of systems ideas [Katz & Kahn, 1966; Thompson, 1967], organization theorists have focused on the interaction of organizational conditions and organizational processes in...
producing behavior. However, while some conceptual models of organizational behavior are process oriented [Child, 1972; Weick, 1969], the methods used to tap these processes have been static in nature (except, of course, for case studies). There has, therefore, been a disjuncture between the frameworks used to conceptualize organizations and the methods used to capture organizational complexity. Network analysis is one method of conceptualizing organizations that captures the intersection of both static and dynamic aspects of organizations by focusing on the linkages between social objects over time.

Origins and Perspective

The network approach is not new. Its conceptual origins can be traced to three broad schools of thought.

1. Sociology: the process outlook of theorists like Park [1924] and Cooley [1956], and fathered by Simmel [1950], emphasized patterns of interaction and communication as the key to understanding social life. The popularity of functionalism [Parsons, 1960; Mitchell, 1969] led to a consolidation of the viewpoint with a focus on the underlying determinants of recurring social relations.

2. Anthropology: the exchange theories of Levi-Strauss [1969], Malinowski [1922], and Frazer [1919] emphasized the content of the relationships joining individuals, the conditions under which they would exist, and the evolution of these bonds over time [Homans, 1961; Blau, 1964; Ekeh, 1974].

3. Role Theory: Katz and Kahn [1966] define organizations as “fish nets” of interrelated offices. Although role systems imply network concepts, the literature on role analysis has been limited to first-order role sets (individuals directly linked to the focal person) and evidences an individual bias [Kadushin, 1968; Gross, Mason, & McEachern, 1958].

On the empirical side, Whyte [1955] and Chapple and Sales [1961] were among the earliest organization researchers to use network concepts. The large-scale studies of voting behavior and the diffusion of innovations subsumed network concepts [Katz & Lazarsfeld, 1955; Coleman, Katz, & Menzel, 1957; Rogers & Shoemaker, 1971]. On the experimental side, the studies of Bavelas [1951] and Leavitt [1951] conceived of group structure explicitly in network terms. Finally, the network approach has a tradition in community power studies, rural anthropology [Mitchell, 1969; Boissevain, 1974], and in the research and development management literature [Allen, 1977].

In short, although the combination of theory and research shows that there has been interest in a

Table 1

<table>
<thead>
<tr>
<th>Property</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Transactional Content</td>
<td>Four types of exchange</td>
</tr>
<tr>
<td>1. expression of affect</td>
<td></td>
</tr>
<tr>
<td>2. influence attempt</td>
<td></td>
</tr>
<tr>
<td>3. exchange of information</td>
<td></td>
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<tr>
<td>4. exchange of goods or services</td>
<td></td>
</tr>
<tr>
<td>B. Nature of the Links</td>
<td>The strength of the relation between individuals.</td>
</tr>
<tr>
<td>1. Intensity</td>
<td></td>
</tr>
<tr>
<td>2. Reciprocity</td>
<td>The degree to which a relation is commonly perceived and agreed on by all parties to the relation (i.e., the degree of symmetry).</td>
</tr>
<tr>
<td>3. Clarity of Expectations</td>
<td>The degree to which every pair of individuals has clearly defined expectations about each other’s behavior in the relation.</td>
</tr>
<tr>
<td>4. Multiplexity</td>
<td>The degree to which pairs of individuals are linked by multiple relations.</td>
</tr>
<tr>
<td>C. Structural Characteristics</td>
<td>The number of individuals participating in the network.</td>
</tr>
<tr>
<td>1. Size</td>
<td></td>
</tr>
<tr>
<td>2. Density (Connectedness)</td>
<td>The number of actual links in the network as a ratio of the number of possible links.</td>
</tr>
<tr>
<td>3. Clustering</td>
<td>The number of dense regions in the network.</td>
</tr>
<tr>
<td>4. Openness</td>
<td>The number of actual external links of a social unit as a ratio of the number of possible external links.</td>
</tr>
<tr>
<td>5. Stability</td>
<td>The degree to which a network pattern changes over time.</td>
</tr>
<tr>
<td>6. Reachability</td>
<td>The average number of links between any two individuals in the network.</td>
</tr>
<tr>
<td>7. Centrality</td>
<td>The degree to which relations are guided by the formal hierarchy.</td>
</tr>
<tr>
<td>8. Star</td>
<td>The individual with the highest number of nominations.</td>
</tr>
<tr>
<td>9. Liaison</td>
<td>An individual who is not a member of a cluster but links two or more clusters.</td>
</tr>
<tr>
<td>10. Bridge</td>
<td>An individual who is a member of multiple clusters in the network (linking pin).</td>
</tr>
<tr>
<td>11. Gatekeeper</td>
<td>A star who also links the social unit with external domains.</td>
</tr>
<tr>
<td>12. Isolate</td>
<td>An individual who has uncoupled from the network.</td>
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</tbody>
</table>
network approach, there has yet to emerge a comprehensive model based on network thinking that is capable of guiding our understandings of social and, in particular, organizational processes.

**Social Network Concepts**

Table 1 lists some elementary network properties that will be used in this article. The intent is to familiarize readers with accepted terminology and provide a common set of tools.

Three sets of properties of networks are of particular interest:

A. **Transactional Content**: what is exchanged by the social objects. For instance, two employees may exchange information or affect.

B. **Nature of the Links**: this property refers to the strength and qualitative nature of the relation between two social objects.

C. **Structural Characteristics**: this property refers to the overall pattern of relationships between the system’s actors. For instance, clustering, network density, and the existence of special nodes in the network are all structural characteristics.

**Transactional content** What is exchanged when two actors are linked? Four types of transactional contents can be distinguished: (1) exchange of affect (liking, friendship), (2) exchange of influence or power, (3) exchange of information, and (4) exchange of goods or services.

Social networks can, then, be developed for each content type. These networks may or may not overlap and an individual’s position in the networks may vary. For example, the information exchange network might be decentralized and fully connected, while the influence network might be centralized, with interactions mediated by the formal supervisor [Katz & Tushman, 1979].

**Nature of the links** The linkages between pairs of individuals can be described in terms of several characteristics:

1. **Intensity**: the strength of the relation as indicated by the degree to which individuals honor obligations or forego personal costs to carry out obligations [Mitchell, 1969], or by the number of contacts in a unit of time.

2. **Reciprocity**: the degree to which individuals report the same (or similar) intensities with each other for a content area.

3. **Clarity of expectations**: the degree to which individuals agree about appropriate behavior in their relations to one another.

4. **Multiplexity**: individuals have multiple roles, such as worker, husband, community member, and group member. Multiplexity identifies the degree to which a pair is linked by multiple roles. The more role requirements linking one person to another, the stronger the linkage.

**Structural characteristics** Structural characteristics can be divided into four levels:

1. **External network**: in what ways is the focal unit linked with external domains? Given some external linkage, in what ways is the set of actors linked [Aldrich & Herker, 1977; Pennings, 1978].

2. **Total internal network**: given a set of actors that make up the network, in what ways are they linked?

3. **Clusters within the network**: areas of the network where actors are more closely linked to each other than they are to the rest of the network are termed clusters [Boissevain, 1974]. There are various types of clusters: formally prescribed work groups, emergent coalitions, and cliques. A coalition is a temporary alliance of actors who come together for a limited purpose [Thibaut & Kelley, 1959]. Cliques are more permanent informal associations and exist for a broader range of purposes — e.g., task, social, and career [Burns & Stalker, 1961; Tushman, 1979; Tichy, 1973].

4. **Individuals as special nodes within the network**: not all individuals are equally important in social networks. Key nodes exist to link a focal unit to other areas within the organization (liaison), as well as to areas outside the organization (gatekeepers). Individuals can also be uncoupled from the rest of the network (isolates) [Schwartz & Jacobson, 1977; Tushman, 1977].

Table 1 presents a set of indices describing the structural characteristics of networks. These properties can be used at each of the three levels of analysis. For instance, connectedness can refer to the extent to which several organizations are interrelated, or the extent to which persons within an organization are interrelated.

In sum, the social network perspective views organizations as consisting of social units with relatively stable patterns of relationships over time. The
traditional formal/informal dichotomy is reflected in these relationships and the framework makes it possible to compare and contrast formally prescribed and emergent relationships in a coherent fashion. Organizations can then be seen as made up of both prescribed and emergent groupings, each with its own structural characteristics. These groupings can be described in terms of their interrelations as well as their relations with external domains. Further, the network perspective suggests that the networks may well be different over different content areas; and it provides a vehicle for linking these networks over multiple levels of analysis.

**Network Analysis Methods**

Different types of data can be used in network analysis. On the objective level, data on shared attributes can be used. For instance, interorganizational theorists would argue that two organizations are related if they share a director or if they exchange employees [Pennings, 1978; Levine, 1972]. On the subjective level, individuals can be asked to interrelate a series of factors to arrive at an aggregate cause map, or an intra-individual network [Bougon, Weick, & Binkhardt, 1977].

For the most part, however, network analysis relies heavily on sociometric data. Sociometry is a method for ascertaining the relationship between units. The degree (often merely the presence or absence of a relation) to which each unit is related to all other units is mapped. When the relationships between all units are mapped, a graph or sociogram displays the network of relationships [Kadushin, 1970]. Sociometric data are deceptive. They are easy to collect, yet once they are collected, there are immense difficulties in analysis.

**Data Collection**

Table 2 presents four basic network data collection methods, with their major strengths and weaknesses. These trade-offs should be weighed in the context of research requirements.

**Positional analysis** This method entails the use of formal organizational data, often reflected in an organization chart, which details prescribed reporting or communication lines. Positional data are the easiest type to collect because most organiza-

<table>
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<tr>
<th>Method</th>
<th>Strengths</th>
<th>Weaknesses</th>
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<tbody>
<tr>
<td>1. Positional Analysis (Formal Communication/Influence)</td>
<td>Easy Access</td>
<td>Least accurate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Must be used with other methods</td>
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<td>2. Reputational/Attributional</td>
<td>Simplicity of design and data collection Can deal with multiple networks Limited sample size</td>
<td>Taps only perceived networks Status bias often built in Specification of where to cut off “snowball” often arbitrary No way to choose “right” issues Questions of reliability with data</td>
</tr>
<tr>
<td>3. Decisional Analysis</td>
<td>Reconstructs networks Can deal with multiple networks Issue specific</td>
<td>Ignores indirect, subtle influence Definition of key issues important Choice of issues important Problems with managing “snowball” sample</td>
</tr>
<tr>
<td>4. Interactional Analysis</td>
<td>Benefits of all the above approaches Easy to gather Reliability of data</td>
<td>Definition of boundaries Need for high return rate (total universe needed) Costly to manage and administer Requires high commitment on part of respondent, also high trust</td>
</tr>
</tbody>
</table>
tions have them formally mapped out. However, this is the least informative of all network methods because it fails to tap the actual ongoing processes of the organization. Positional analysis is most appropriately used as an indication of the prescribed network.

Reputational / attributional method  This method has been used to study community power [Rose, 1968; Hunter, 1953]. Because overt behavior portrays an incomplete picture of influence, this method attempts to get behind the scenes by using judgments of selected community members as to "who are the top leaders" or "who are the most influential persons in your community." Persons most frequently selected constitute the "first-rate leaders." Given these elites, the method goes on to investigate, through interviews, the influence or communication networks [Hunter, 1953]. Hunter simply asked for general "influentials," but others [Perrow, 1970; Clark, 1968] have used this method for studying individuals influential in specific areas. Since Hunter's study, this technique has created much controversy, both with respect to the method and the community-elite interpretations [Rose, 1968, pp. 257-277].

Supporters of the method note its simplicity in design, replicability, validity, and potential sensitivity to influence in different decision-making areas [Herson, 1961]. The method captures perceived power, and there is evidence that perceived and exerted influence are highly related [Gamson, 1966]. Its detractors note that the "elitist methods" wrongly equate reputed with actual power, are inherently static, are biased by asking the wrong questions (i.e., "who runs the community"), and have operational cut-offs that are not defendable (i.e., panel selection, number of elites). Wolfinger [1962] and Dahl [1958] go into detail on these points.

Decisional analysis  This approach, advocated by Dahl and his followers [e.g., Polsby, 1963; Wolfinger, 1962], criticizes both positional and reputational methods as ineffective means for ascertaining influence networks. Decisional analysis highlights "the process of decision making as the nucleus of the phenomenon of power, and it is this process that is the object of research" [Dahl, 1963, p. 53]. Those using decisional analysis are not interested in the reputedly powerful; they would rather select a number of key issues, identify the participants in decision making, determine outcomes, and then appraise relative influence. This approach has been used during actual decision processes [Pettigrew, 1973; Banfield, 1961] and retrospectively [Wildavsky, 1964; Baldridge, 1971].

The benefits of the decisional method lie in its concreteness: overt behavior is studied. Leaders can be empirically distinguished from the "2nd stringers," content overlap can be easily investigated, if a number of issues are studied, precise linkages can be found, and the sequencing of influence can be traced. Yet the concreteness is also a source of problems. More specifically, this method has been criticized (1) for neglecting indirect and subtle decision influence, (2) for its potential lack of generalizability, (3) for the difficulty of defining key issues, (4) for its complexity in time and energy, and (5) for its neglect of the nondecision-making process, such that only "safe" issues are studied [Anton, 1963; Bachrach & Baratz, 1962].

Both the reputational and decisional analysis methods have generated much heat and rhetoric, and each typically finds different sets of influencers and power/influence networks [Polsby, 1963]. Yet as Freeman and his colleagues [1963] and Pressthus [1965] observe, both approaches taken together give a more complete picture of the influence or communication network. The reputational method highlights key actors in the decision, while decisional analysis highlights the substance and intensity of the influence process. It is in this dual use that there is relevance for organizational studies. Decisional analyses may be more appropriate in simple organizations, and the dual approach will probably be more effective for more differentiated systems [Clark, 1968].

The last approach to be discussed can be seen as an adaptation of the decisional and reputational methods in that it gets at attributions of communication and influence.

Interactional methods  In this approach, the flow of interactions (or influences) and their feedback is the central focus, and power is taken to be a constraint guiding these flows [Clark, 1968]. The communication or influence networks are derived from either time series or single-point surveys ad-
ministered to the whole system. Individuals are asked to report their interactions or influence attempts over the period studied and for particular content areas [Frey, 1976; Barnes, 1969; Brams, 1968]. With these data, interaction nets and power relations can then be determined [Brams, 1968; Barnes, 1969].

There are many ways of collecting this type of data. The most general format asks respondents to summarize their interactions — for example: “In a normal week, who are the people you interact with to get your work done?” To reduce bias caused by asking respondents to keep a log of their activities for selected days. These real-time data yield more accurate information; however, this approach calls for considerably more data-management time [Tushman, 1979a; 1979b]. Unobtrusive methods can also be used to collect interaction network data. Appointment calendars, telephone bills, memos, letters, and minutes of meetings can all provide sociometric data. Finally, as was illustrated by Whyte [1955], observational methods are yet another way to collect interactional sociometric data.

Although interactional methods get directly at influence/interaction processes, they do have difficulties and limitations. These include: the assumption of a closed system (or at least of a bounded system), the necessity for a high response rate, and — if more detailed information is desired (e.g., intensity, content) — the increased interviewing or observational expense.

Each of these four data-collection strategies has its strengths and weaknesses (see Table 2). Accordingly, investigators will have to tailor their data-collection strategy to fit their research requirements. However, multiple methods will, in general, provide the most comprehensive view of the system [Kadushin, 1968; Baldridge, 1971].

Network Methodology and the Analysis of Data

There have been few large-scale network studies of organizations. The earliest studies date back to the work of the Michigan group in the 1950s [Jacobson & Seashore, 1951; Weiss & Jacobson, 1955]. Using matrix permutation techniques [Forsythe & Katz, 1946], they analyzed communication patterns in the U.S. Office of Naval Research. The subgroupings or cliques that gradually emerged within the matrix were considered the building blocks of the informal structure. Owing to the lack of an integrating theory and a sophisticated network methodology, sociometric research was largely ignored for two decades [Rogers & Rogers, 1976, p. 124].

In the late 1960s network analysis resurfaced as a tool for studying communication patterns. The increasing acceptance of the systems paradigm, formulated in the context of organizations [Katz & Kahn, 1966], instigated a series of dissertations with communication as the core dependent variable [Schwartz, 1977]. At MIT, Allen began investigations into the communication networks of R and D laboratories [Allen & Cohen, 1969]. Roberts and her colleagues have also been applying network concepts to studies of communication [Roberts & O’Reilly, 1976; O’Reilly & Pondy, 1979].

Difficulties in analyzing sociometric data

The methodological difficulties of dealing with sociometric data are exacerbated because of a paradox. The collection of sociometric data makes a great deal of intuitive sense; it is tied to a conventional view of the world — whom you know, whom you speak to, and so forth. It is also extremely easy to collect. The result is that investigators can easily gather an overabundance of data.

Assume that data are collected — say from 100 people in an organization — concerning who influences them most on work matters. What should the researcher do with the data? Clearly, the standard tools of regression, discriminant, or factor analysis are not readily applicable. What approaches does the researcher need to work with? Some of the questions that the researcher might want to answer are: Are there individuals who do not influence anyone? Are there individuals who influence a disproportionate number of people? What are the linkages between the most influential individuals?

With answers to these questions, our researcher might begin to draw lines around groups of individuals who influence each other more than they do anyone else; he or she might point out some individuals who are isolates within their groups and others who are strongly interconnected, and thereby derive characteristics of the organization’s social structure. By hand, of course, the task is a weighty one and one besieged with problems such that Kadushin [1978] reports that in a secondary analysis of a sample of published sociograms, none with
more than 40 people were accurate.

There have been mathematical approaches to sociometric data analysis [Harary & Cartwright, 1965]. Starting with a matrix of nominations, these approaches arrange individuals on the basis of similarity with respect to the criterion. Techniques have ranged the gamut from matrix permutations [Forsyth & Katz, 1946; Hubbel, 1965] to graph theoretical models [Luce & Perry, 1949; Alba, 1972]. Despite their sophistication, however, these techniques have until recently remained for the most part extremely cumbersome to apply to large data sets.

Computers and sociometry The breakthrough for network methodology has been the use of computers [Roistacher, 1974]. There are a number of computer algorithms available for analyzing sociometric data. Some of the better-known ones are DIP [Gleason], SocPac [Leinhart, 1977], SOCK and COMPLT, BLOCKER and CONCOR [Breiger, Boorman, & Arabie, 1975; Arabie & Boorman, 1973]. According to Roistacher [1974], the most complete sociometric program available for distribution, and the only one approximating a sociometric utility system, is Alba’s [1972] SOCK.

In general, two sets of methods are used for analyzing network data. The first is grounded in the manipulation of proximity measures, where proximity is an index that reflects the social distance between individuals [McFarland & Brown, 1973]. A variety of measures have been suggested. For instance, Breiger et al. [1975] use the product-moment correlations between the column vectors of nominations received by two individuals as an index of social proximity; Alba and Kadushin [1976] suggest that two individuals are proximate if they are linked to the same individuals. Closely related is Lorrain and White’s [1971] concept of structural equivalence, used by Breiger et al. [1975] to define block-modeling, a technique that essentially clusters structurally equivalent individuals. SOCK is a system that reads in sociometric data and allows the user to call various routines that generate pairwise measures of proximity. The proximity measures are then used either to cluster individuals into highly interrelated groups using Johnson’s [1967] hierarchical clustering algorithm, or as input to Kruskal’s [1964] multidimensional scaling algorithm to provide a plot of the proximity matrix in $u$-space ($u$ is chosen by the user). This plot tries to represent the network in space in such a way that the distances between points are scaled to the social proximities between individuals [Alba & Gutmann, 1972]. Unfortunately, the fit is only monotonically accurate and the plot is nonlinear. The configuration can be useful, however, since it allows for visually identifying isolates and making preliminary guesses at the group structure.

The other set of methods is grounded in graph theory and follows Luce and Perry’s [1949] seminal article. COMPLT computerizes their suggestions. Clusters are extracted from the data in a two-step procedure [Alba & Gutmann, 1974]. All the maximally connected subgroups are extracted, and are then merged if they differ by no more than one point from each other. The resulting groupings are then aggregated on the basis of an overlap parameter specified by the user.

Both types of methods can be used simultaneously, and the next section discusses a case example that uses both SOCK and COMPLT in the analysis.

Analyzing Organizations Using A Network Framework: A Case Example

In this section, the network approach is used to complement more traditional approaches to organization design and structure. Data are drawn from Payne and Pheysey’s [1973] study of three organizations, itself a result of a larger Aston study [Pugh, Hickson, Hinnings, & Turner, 1969]. A complete secondary analysis of their data can be found in Tichy and Fombrun [1979].

Theoretical Focus

The assessment is based on a contingency theory of organizations. The argument — derived from Burns and Stalker [1961], Lawrence and Lorsch [1967], Pugh et al. [1969], Tushman [1979], Hage, Aiken, and Marrett [1971], and Galbraith [1973] — is that mechanistic structures are most appropriate under conditions of high task uncertainty. A mechanistic organization uses bureaucratic principles to design, plan, and prescribe roles. Thus, the influence and information channels in mechanistic organizations should be highly pre-
scribed. Given high task certainty, individuals will have little discretion in their choice of work-related contacts. This implies that the emergent network of interaction will closely follow the prescribed network in a mechanistic setting. Organic organizations are most effective when the unit’s task is uncertain. Because complex or highly variable tasks cannot be preprogrammed, it may be that informal relations arise to accomplish them. If so, then in organic organizations, emergent networks may differ considerably from prescribed networks.

In sum, given one mechanistic and one organic organization, we would expect to find different patterns of relationships to prevail in each. Network data should clearly point up the difference.

Setting and Procedure

The two organizations, code-named Aston and Brum, were drawn from the Aston sample [Pugh et al., 1969; Payne & Pheysey, 1973]. Table 3 presents the organization scores on the neo-Weberian dimensions of organization structure. On the basis of structuring and centralization, Brum is clearly more organic than Aston, despite Brum’s larger size.

Sociometric data were collected by interactional analysis. The top management groups (20 managers at Aston, 13 at Brum) were asked:

Think back over the past month. Consider all the people in your department; i.e., your superiors, your subordinates, and people at the same level as yourself. Please write down the names of those with whom you have spent the most time on work matters. List the names, in order, so that the first person is the one with whom you have spent the most time.

Results

From a network perspective, the first desirable outcome is to get a sense of the total configuration. This “gestalt sociology” approach should intuitively suggest areas worthy of investigation.

Figure 1 gives us the output from the multidimensional scaling segment of SOCK, plotted in two dimensions. The closer two points are on the diagrams, the more similar these individuals are in terms of their interactional environments [Alba & Kadushin, 1976]. Note that, although these distances are only ordinal in nature, Figure 1 gives us a view of the total network configurations based on interaction linkages. It therefore presents a social map of the organization.

Superimposed on the SOCK plots are the clusters derived from the COMLT procedure. In combining both SOCK and COMPLT, the diagrams of Figure 1 show two-dimensional interactional maps of the organizations that provide three basic types of information:

1. relative social distance between individuals, representing the similarity of their network ties;

Table 3
Characteristics of Two Organizations

<table>
<thead>
<tr>
<th></th>
<th>Aston</th>
<th>Brum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Employees</td>
<td>350</td>
<td>412</td>
</tr>
<tr>
<td>Woodward Technology</td>
<td>small</td>
<td>small</td>
</tr>
<tr>
<td>Structuring Activities</td>
<td>57a</td>
<td>35a</td>
</tr>
<tr>
<td>Concentration of Authority</td>
<td>47a</td>
<td>27a</td>
</tr>
<tr>
<td>(Centralization at higher levels)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Levels of Hierarchy</td>
<td>5</td>
<td>8</td>
</tr>
</tbody>
</table>

aScores on these variables are standard scores, having a mean of 50 and a standard deviation of 15, based on the original sample of 52 midland organizations.
2. the formal status of individuals (1 = top management, 2 = middle management, and 3 = supervisory);

3. clusters indicating densely connected groups.

The interaction network in Aston can be separated into three overlapping clusters. Cluster 1, the largest, comprises all top and middle managers. Cluster 2 consists of the manager of one division and his two subordinates, and the third cluster includes the middle manager of the other division (individual #9) and a subset of his staff.

The SOCK plots arrange individuals in Aston into three layers corresponding to the prescribed statuses. From Figure 1(A), all of the top managers (1s) are in the first layer, at the bottom; all of the middle managers (2s) are in the second layer; and the supervisory staff (3s) are in the third layer, at the top. The narrow cluster of top people with a slightly wider cluster of middle people and the broader cluster of lower-level people is reminiscent of the familiar pyramidal structure of bureaucratic organizations. Given Aston’s status as a very mechanistic organization, this is not surprising. Individuals interact more closely with people on their prescribed levels. Bridge roles #6, #9, and #10 are the farthest members from the middle group and the closest to the supervisory group, as would be expected. Sociometric stars are individuals #6 and #9, the two principal “linking pin” roles. Finally, individual #4 is an isolate. He is also a member of Aston’s top management.

Brum, the more organic organization, is layered from top to bottom as well. Figure 1(B) indicates, however, that the top group of Brum is not quite as cohesive as that at Aston. The middle managers seem more central in terms of interaction with both top and bottom levels. The stars of the network, #2 and #4, are centrally placed on the organization chart and provide liaison with the top.
On the basis of the organization chart, it is possible to define the kind of interactional clusters we would expect to observe in each organization. In Figure 1, these expected clusters are plotted in dotted lines. The clusters derived from COMPLT, based on observed interaction patterns, are plotted in dark lines.

Comparing the expected and actual clusters, Figure 1 suggests that, at Aston, high overlap exists. There is a relatively close fit between the prescribed and emergent clusters of interaction. At Brum, the emergent cluster comprises all the members sampled. As predicted, actual interaction patterns went above and beyond the prescribed interaction patterns. It seems, then, that the emergent interaction networks in the two organizations are of the form predicted from a contingency point of view.

Because these data have been presented to illustrate network analysis, we do not carry the analysis to the next step, which involves deriving indices corresponding to the characteristics listed in part C of Table 1. Most of these indices are included as part of the SOCK and COMPLT computer output.

With this example we have tried to show the utility of a network approach to organizational research. The method is especially useful in that it facilitates the comparative analysis of organizations as well as the comparison of subunits within an organization.

Conclusion

The social network framework, methods, and a case example were presented to support our claim that significant advances can be made in organization theory and research using this approach. Such optimism for the future of social network analysis is not meant to hide the considerable hurdles ahead. Many significant problems need to be overcome before we can speak of a network paradigm. For example, the stability of networks needs to be understood. Why do they change, and by how much and how frequently do they change under different sets of conditions? Can we rely on a particular data set collected at a point in time, or is this problematic, owing to the instability of networks over time?

In sum, while there are real costs involved with further developing the social network approach, the benefits are substantial and appear to far outweigh the costs. Network analysis represents an under-utilized framework for analyzing and conceptualizing organizations. Our research agenda for studies based on network analysis includes:

1. Interorganizational relationships. Evan's [1966] notion of the organization set can be greatly expanded to look at wide-reaching external networks linking organizations. Also, studies of interlocking directorates can be more systematic [Pennings, 1978].

2. Organizations and their boundaries. The study of boundary permeability and boundary-spanning networks is a promising area for both conceptual and empirical development.

3. Career patterns and succession. Studies of the role and functioning of networks in career mobility are needed [Granovetter, 1974].

4. Organization change. Network analysis provides (a) diagnostic tools for the planning of change, (b) tools for measuring the impact of change efforts, and (c) a set of explanatory variables for how change agents affect organizations.

5. Design configuration. Contingency theories of organization design [Galbraith, 1973; Lawrence & Lorsch, 1967] have overlooked the emergent networks associated with different design configurations. Such an assessment is called for.

6. Power and political processes. The study of organizations and leadership behavior from a political perspective is more amenable to systematic analysis based on a network perspective [Thompson, 1967; Tushman, 1977a; Wolfinger, 1960].

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