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Structural analysis: from method and metaphor to theory and substance

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(Mis)conceptions

Structural (or network) analysis has mystified many social scientists. Some have rejected it as mere methodology, which lacks due regard for substantive issues. Some have fled from its unusual terms and techniques, not having played with blocks and graphs since grammar school. Some have dismissed one portion for the whole, saying, for example, that their study of class structure has little need for the focus on friendship ties emphasized in network analysis. And some have scorned it as nothing new, claiming that they also study "social structure." Others have bolted on variables such as network "density" as they would a turbocharger in order to boost explained variance. Still others, attracted by the capability of studying nonhierarchical, nongroup structures, have expanded structural analysis into a network ideology that advocates egalitarian, open communities. Some have even used "network" as a verb and "networking" as a noun to advocate the deliberate creation and use of social networks for such desired ends as getting jobs or integrating communities.

These misconceptions have arisen because too many analysts and

practitioners have (mis)used "structural analysis" as a mixed bag of terms and techniques. Some have hardened it into a method, whereas others have softened it into a metaphor. Many have limited the power of the approach by treating all units as if they had the same resources, all ties as if they were symmetrical, and the contents of all ties as if they were equivalent.

Yet, structural analysis does not derive its power from the partial application of this concept or that measure. It is a comprehensive paradigmatic way of taking social structure seriously by studying directly how patterns of ties allocate resources in a social system. Thus, its strength lies in its integrated application of theoretical concepts, ways of collecting and analyzing data, and a growing, cumulating body of substantive findings.

Until recently, structural analysis has had neither a basic programmatic statement nor a standard text. Instead, it has tended to accumulate partial principles and conclusions from empirical studies and oral lore. There have been three distinct research traditions, and most adherents of each tradition have not assimilated the work of the other two. Hence, rather than adopt one standard model, structural analysts have used a number of different models with shared family resemblances. Now, much work is coalescing, and researchers are forming groups, starting their own journals, and publishing widely in mainstream books and journals.[1]

In the course of time, structural analysis has emerged as a distinctive form of social inquiry having five paradigmatic characteristics that provide its underlying intellectual unity:

1. Behavior is interpreted in terms of structural constraints on activity, rather than in terms of inner forces within units (e.g., "socialization to norms") that impel behavior in a voluntaristic, sometimes teleological, push toward a desired goal.
2. Analyses focus on the relations between units, instead of trying to sort units into categories defined by the inner attributes (or essences) of these units.
3. A central consideration is how the patterned relationships among multiple alters jointly affect network members' behavior. Hence, it is not assumed that network members engage only in multiple duets with separate alters.
4. Structure is treated as a network of networks that may or may not be partitioned into discrete groups. It is not assumed a priori that tightly bounded groups are, intrinsically, the building blocks of the structure.
5. Analytic methods deal directly with the patterned, relational nature of social structure in order to supplement – and sometimes supplant – mainstream statistical methods that demand independent units of analysis.

My objective in this chapter is to describe this structural analytic paradigm: its development, distinguishing characteristics, and analytic principles. Not all structural analysts will agree with my description. Indeed, some would not even call themselves "structural analysts." Nevertheless, I believe that I am able to show a fundamental unity underlying the many studies that I discuss.

Research traditions

The (mostly British) anthropological development of the social network concept

The concern of structural analysts with the direct study of networks of concrete social relations connects strongly back to post–World War II developments in British social anthropology.[2] Then as now, anthropologists paid a good deal of attention to cultural systems of normative rights and duties that prescribe proper behavior within such bounded groups as tribes, villages, and work units. Although British "structural-functionalists" had used network metaphors as partial, allusive descriptions of social structure (e.g., Radcliffe-Brown, 1940; see also Sundt, 1857; Bohannan, 1954), their research had focused on how cultures prescribe proper behavior within bounded groups (Boissevain, 1979). Not only were such cultural systems simpler to describe than the great variety of actual behavior, but the structural-functionalists believed that in focusing on culture they were reducing behavioral noise and thus getting at the essence of social systems.

Whatever the merits of such normative analyses when applied to bounded groups, they have difficulty in dealing with social systems in which ties cut across "the framework of bounded institutionalized groups or categories" in complex ways (Barnes, 1969: 72). To study these crosscutting ties, several anthropologists in the 1950s shifted attention away from cultural systems toward structural systems of concrete ties and networks (e.g., Nadel, 1957; Barnes, 1971) and began developing social network concepts more systematically and self-consciously. These analysts defined a network as a set of ties linking social system members across social categories and bounded groups.

Some anthropologists especially felt the need for network analytic tools after World War II when they began studying large streams of migrants leaving culturally homogeneous villages and tribes for polyglot cities and industrial areas. They feared that these migrants, in leaving behind the normative guidance of their homelands, would become isolated and disorganized in "mass societies." Administrators worried that these new urbanites would be prone to sink into apathetic despair or to strike out in unstructured, mindless mobs (these views are summarized in Kornhauser,

1968). Yet investigators soon discovered that not only were the migrants forming strong, supportive ties within their new urban milieux, they were retaining strong ties to their ancestral rural homelands. Rather than wilting under the impact of urbanization, industrialization, capitalism, and technological change, the migrants were enmeshed in complex and supportive social networks, cutting across tribal, residential, and workplace boundaries.[3]

This research focused on the migrants' actual ties rather than on the ties that normative prescriptions suggested that they *ought* to have. Such work soon came together with similar anthropological work on concrete social relations in western social systems. In 1954, Barnes had self-consciously used the concept of "the social network" to analyze the ties that cut across kinship groups and social classes in a Norwegian fishing village. Not only did the network concept help him to describe more accurately the social structure of the village, but it was more useful than normative concepts in explaining such key social processes as access to jobs and political activity. Soon afterward, Bott's (1957, 1971) work brought the network concept to the wider attention of social scientists. She developed the first distinct measure of network structure – "knit" (now called "density") – to show that densely knit, English extended families were more apt to contain married couples who did most things independently rather than jointly.

These anthropological network analysts shared with their structural-functional kindred a resolute British empiricism. They differed from them in emphasizing concrete social relations and not cultural prescriptions. They insisted on starting with these relations and then discerning the social structure inherent in the underlying patterns of behavioral exchanges.

At first, the anthropological network analysts saw the network concept as just one (albeit, important) addition to the social scientist's battery of intellectual tools, which provided a way to incorporate crosscutting relationships into analyses hitherto confined to bounded groups. They began to develop basic quantitative measures of properties such as density to describe the form of social networks. As their work progressed, these anthropologists gradually expanded the scope of their claims for the usefulness of "social network analysis" (as the approach came to be called).

The (mostly American) increase in quantitative analysis and substantive scope

Whereas the British anthropologists moved from questions of substance to the study of network form, much American structural analysis started with questions of network form: Do patterns of relations in networks, for example, affect the ways in which social systems operate? With the post–World War II translation of Georg Simmel's work into English (e.g., 1950,

1955, 1971), many American sociologists became acquainted with his early twentieth-century argument that the forms of social relations greatly determine their contents. They drew from his work an interest in how the size of social systems and the ways in which relationships are interconnected constrain individual behavior and dyadic exchange. To some, such a *structural* emphasis was a welcome challenge to the more psychologistic, needs-driven analyses advocated by the dominant American sociological brand of structural-functionalism (e.g., Parsons, 1951, 1960).

As knowledge of the British anthropologists' work diffused across the Atlantic, it intersected with, reinforced, and modified American sociological interest in structural analysis. The scope of inquiries expanded, as British empiricism fit well with the American penchant for quantitative measurement and statistical analysis.

American interest in structural form stimulated efforts to map interpersonal relations and to develop fine-grained methods for describing their patterns. "Sociometrists" started using network diagrams to represent interpersonal relations in small groups (e.g., Coleman, 1961; for a precursor, see Moreno, 1934). Subsequently, epidemiologists and information scientists began conceiving of the diffusion of disease, information, and sundry other things as a social network phenomenon (Coleman, Katz, and Manzel, 1966; Rapoport, 1979; Rogers and Kincaid, 1981).

Structural analysts then began using the vocabulary of rudimentary "graph theory" – the field of mathematics devoted to studying the arrangement of points and lines – to describe linkages among the members of social systems and to manipulate these representations in order to probe the underlying "deep structures" connecting and cleaving social systems (Harary, Norman, and Cartwright, 1965; Frank, 1981). Yet point-and-line diagrams are cluttered when used to study networks with more than about a dozen members; McCann and White's (Chapter 14) graphic depiction of the citation network of oxygen chemists in the 1780s is at about the outer limits of legibility (see Figure 2.1, which is based on Figure 14.6). Consequently analysts have come to use matrices to study social networks (Figure 2.2). The use of matrices has made it possible to study many more members of social systems and many more types of ties, and it has fit well with the use of computers to reveal such underlying structural features as cliques, central members, and indirect linkages.

The research group around Harrison White at Harvard in the 1960s and 1970s played an especially important role in these efforts. White wrote key programmatic papers (e.g., 1965, 1966) claiming all of sociologistic sociology for structural analysis. He also performed a variety of exemplary analyses (e.g., 1970a) and trained more than a score of graduate students in his lectures (unfortunately, unpublished) and seminars. In the words of one influential paper, "The presently existing, largely categorical descriptions of social
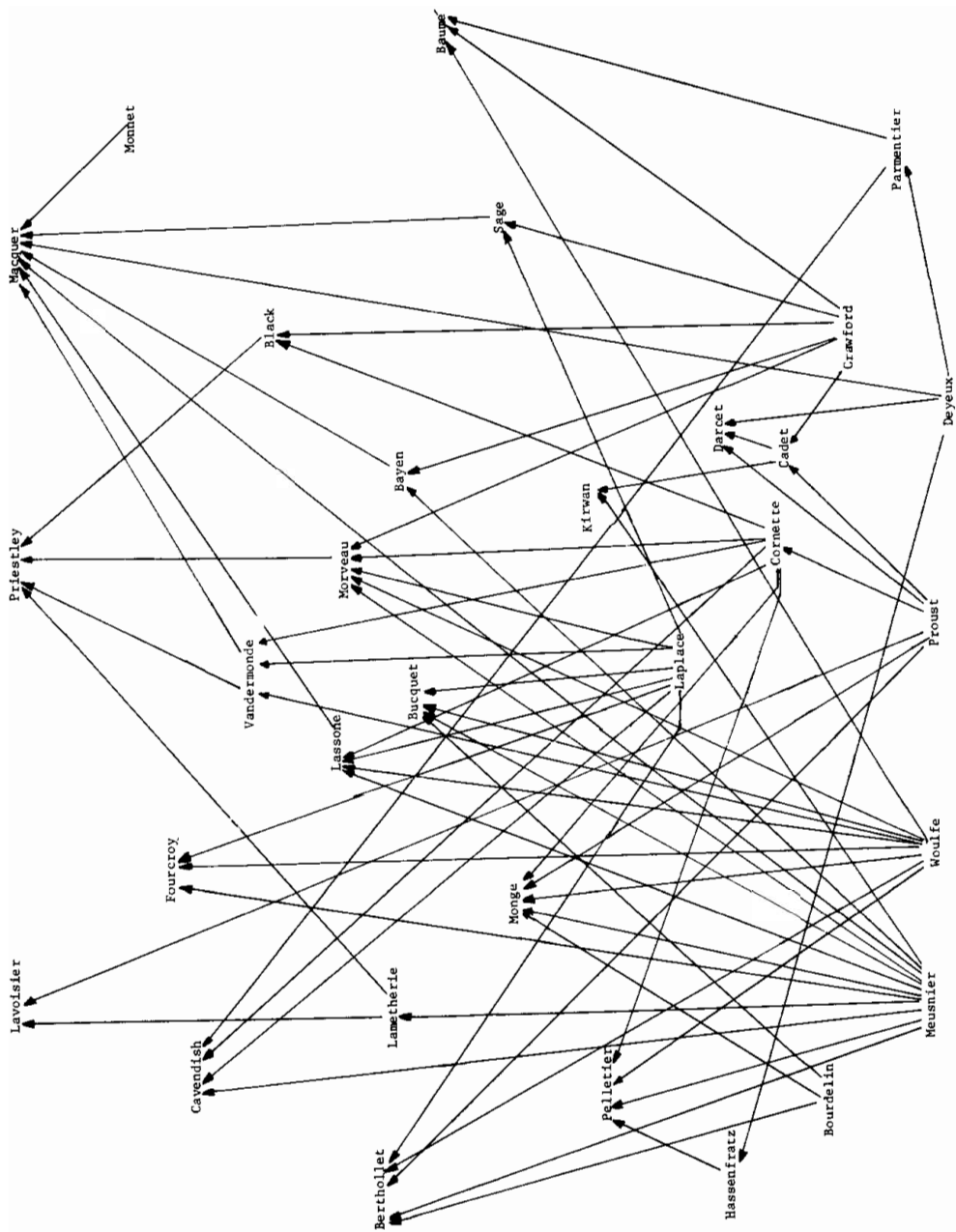
Figure 2.1. Entailment structure of network of chemists, 1785–88. $\phi \geqslant .3$; 2 exceptions; signal-to-noise ratio, 1:1. From White and McCann, this volume. Figure 14.6.

FROM		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Baume	1																															
Bayen	2																				X											
Berthollet	3																															
Black	4																											X				
Bourdelin	5			X			X														X											
Bucquet	6																															
Cadet	7											X				X																
Cavendish	8																		'													
Cornette	9				X				X										X				X		X		X					X
Crawford	10	X	X		X		X																X							X		
Darcet	11																															
Deyeux	12											X			X					X						X						
Fourcroy	13																															
Hassenfratz	14																									X						
Kirwan	15																															
Lametherie	16																			X						X						
Laplace	17			X			X		X					X					X				X								X	X
Lassone	18																				X											
Lavoisier	19																															
Macquer	20																															
Meusneir	21		X	X			X		X					X		X	X		X		X		X		X		X					
Monge	22																															
Monnet	23																				X											
Morveau	24																									X						
Parmentier	25	X							X																							
Pelletier	26																															
Priestley	27																															
Proust	28			X				X	X	X									X		X											
Sage	29																			X												
Vandermonde	30																			X								X				
Woulfe	31	X		X			X							X					X				X		X		X					X

Figure 2.2. Matrix representation of Figure 2.1. Presence of tie represented by *X*; absence of tie represented by blank. [Note: Computer storage would be binary (1/0) or as a vector (e.g., Black—03:27).]

structure have no solid theoretical grounding; furthermore, network concepts may provide the only way to construct a theory of social structure" (White, Boorman, and Breiger, 1976: 732).

American structural analysts have had two distinct sensibilities. An influential minority are *formalists* (e.g., Lorrain and White, 1971; Fararo, 1973; also see many of the papers in Holland and Leinhardt, 1979). Concentrating on the form of network patterns rather than their content, they have shared a Simmelian sensibility that similar patterns of ties may have similar behavioral consequences, no matter what the substantive context. Pushed to its extreme, their argument has been that the pattern of relationships is substantially the same as the content.

The second sensibility, more widely represented in this book, has been a

broad *structuralism*, using a variety of network analytic concepts and techniques to address the substantive questions that have preoccupied most sociologists. Structural analysts with this sensibility have approached these questions from two routes. Many view networks much as astronomers view the universe: as outside observers studying relationships linking all members of a population. The resulting *whole network* studies describe the comprehensive structure of role relationships in a social system. Through manipulating matrices, analysts can find patterns of connectivity and cleavage within social systems, "structurally equivalent" role relationships among system members, changes in network structures over time, and the ways in which system members are directly and indirectly connected.

A basic strength of the whole network approach is that it permits simultaneous views of the social system as a whole and of the parts that make up the system. Analysts are therefore able to trace lateral and vertical flows of information, identify sources and targets, and detect structural constraints operating on flows of resources. Whole network analysts either study the system for its own sake asking, for example, if it is socially integrated or if there is a ruling class or they analyze how the structure of a system affects the behavior and attitude of its members. They ask, for example, if sparsely knit networks lead to sensed social isolation or if persons with ties to two network clusters behave differently from those whose ties are wholly bound up within one cluster (e.g., Kapferer, 1972; Bernard and Killworth, 1973).

Some of the most interesting whole network studies have used memberships on boards of directors to describe relationships between large corporations. Here the nodes of the networks are the large corporations themselves, and the membership of a corporate executive on another corporation's board is used as a trace of a tie between the two corporations.[4] Such work has powerful implications even in its descriptive form: It graphically portrays the overall connectivity of dominant corporations and the presence of interest-group alliances among them. Moreover, the work has predictive power: For example, sectors of the Canadian economy in which the corporations are heavily interconnected tend to have high rates of profit (Carrington, 1981).

Whole network studies are not always methodologically feasible or analytically appropriate. Those who use them find that they must define the boundaries of a population, compile a list of all the members of this population, collect a list of all the direct ties (of the sort the analyst is interested in) between the members of this population, and employ a variety of statistical and mathematical techniques to tease out some underlying structural properties of the social systems. Yet, with the current limitations of computer hardware and software, analysts have been able to study only a few types of relationships in populations no larger than several hundred. Moreover, it is not feasible to obtain complete lists of population members
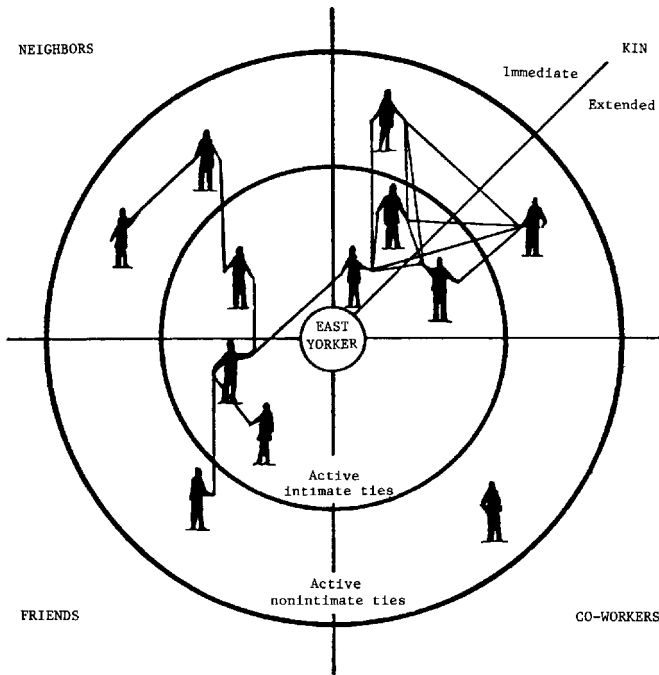
Figure 2.3. Typical personal network of an East Yorker. (See Wellman, Carrington, and Hall, Chapter 6.)

and their ties in many large, naturally occurring settings. Indeed, attempts to impose improper boundaries may often lead to analytic confusion, as was common before 1970 when urban sociologists ignored nonneighborhood friendships and wrongly declared urbanites to be isolated and lonely (see the review in Wellman and Leighton, 1979).

Because of such limitations, many structural analysts have concentrated on studying smaller *egocentric (or personal) networks* – defined from the standpoint of focal individuals. There are positive reasons as well for studying egocentric networks. Rather than showing the universe as it is perceived by an outside observer, they provide Ptolemaic views of networks as they may be perceived by the individuals at their centers.

Figure 2.3, for example, shows the significant interpersonal ties of a typical North American. She is directly tied with each network member (by definition), and she perceives many network members as being linked with each other. (For the sake of clarity, Figure 2.3 omits the direct ties between focal-person and network members.) She is aware of a densely knit core cluster of kin – three of whom she sees as her intimates – and more sparsely knit relations among half a dozen friends and neighbors. In her eyes, only her

one work mate stands apart, the work mate's isolation reflecting both the focal person's separation of employed and social life, and her use of interpersonal ties to deal with domestic concerns and not problems of earning a living (see Wellman, 1985; Wellman, Carrington, and Hall, Chapter 6, for more details).

Egocentric network studies have often meshed well with traditional American survey techniques. Researchers have typically interviewed a (often large) sample of respondents, inquiring about the composition, relational patterns, and contents of "their" networks.

As in the many studies of urban "personal communities," such analyses have demonstrated the continued abundance and vitality of primary relations in social systems transformed by capitalism, urbanization, industrialization, bureaucratization, and technology. These egocentric network studies have documented the pervasiveness and importance of connectivity, thereby rebutting mass society contentions that recent large-scale social transformations have produced isolation and alienation. Numerous scholars have described how networks link individuals through strong and weak ties, situate them in larger social systems, and affect the flows of resources to and from them.

Questions of resource access are closely associated with questions of network form. How does one obtain material goods, emotional support, or information from other network members? A number of studies have demonstrated the effects of different network patterns of access to such diverse resources as jobs, scientific information, abortionists, and emotional support. Investigators have paid a great deal of attention to "social support," and many studies have suggested that the characteristics of their networks may significantly affect focal individuals' health, longevity, and well-being.[5]

In recent years, analysts of both whole and egocentric networks have been concerned with the effects of network properties on the integration of large-scale social systems, a sociological preoccupation since Émile Durkheim. In particular, they have studied:

- the conditions under which triads of ties concatenate to form larger networks (Davis and Leinhardt, 1972; Davis, 1979; Holland and Leinhardt, 1977)
- the addition of new members to networks through ramifying ties (Rapoport, 1979)
- the likelihood of network ties between members of large-scale social systems (Milgram, 1967: White, 1970b; Bernard and Killworth, 1978; Pool and Kochen, 1978)
- the impact of interpersonal network characteristics on the integration of large-scale social systems (Granovetter, 1973, 1982; Laumann, 1973; Brieger, Chapter 4).

Such studies are an important part of the contemporary movement away from treating network properties as just another interesting set of variables. Social network concepts, Simmelian sensibilities, quantitative techniques, and political economic awareness (see the next section) have expanded into a broadly comprehensive structural analytic approach. Having greatly increased the scope and claims of their work, many structural analysts now argue that all social behavior is best analyzed by looking first at the ways in which networks allocate flows of scarce resources to system members.

Structural explanations of political processes

At about the same time that many structural analysts were developing ethnographic and quantitative approaches to studying social networks, others were analyzing political processes as the result of ties of exchange and dependency between interest groups and nation-states. Researchers within this tradition have seldom used structural analytic tools or techniques. Few see themselves as structural analysts. Yet, some have personal and scholarly links with structural analysts and, like them, want to know how patterns of ties in social systems allocate resources unevenly.

One set of scholars in this tradition has been concerned with the ways in which networks and coalitions structure contentions for power *within* states. Their work began as a critique of psychologistic "relative deprivation" studies that sought to explain political behavior in terms of the personal attributes and internalized norms of individuals. Such analyses (e.g., Davies, 1962) usually portrayed politicized groups as collections of rootless individuals made anomic by the dislocations induced by large-scale change. Hence, these analyses have an intellectual tie with the "mass society" argument confronted by British anthropological network analysts and with the "loss-of-community" argument rejected by urban network researchers.

In contrast, structural analysts have developed "resource mobilization" analyses to explain political behavior. They showed such behavior to be due to structured vying for resources by interest groups – and not to reflect the aberrant cravings of a mob. Their work emphasized how patterns of links between interest groups structure coalitions, cleavages, and competitive relations and how direct and indirect ties differentially link individuals and groups to resources (Blok, 1974; Gold, 1975; Pickvance, 1975; Oberschall, 1978; Roberts, 1978; Tilly, 1978, 1979, 1981, Chapter 12; Bodemann, Chapter 8; Brym, Chapter 13). In documenting the existence and importance of connectivity within and between groups, their work has tied in neatly with recent historical research into the demography and structure of families and communities (Anderson, 1971; Laslett, 1971; Tilly and Scott, 1978, Foster, 1974; Katz, 1975; Maynes, 1981).

A second set of scholars has used structural analytic concepts, but not usually network methods, to study dependency links in systems of nation-states and among other macrostructural interest groups. Their work began in reaction to the prevailing scholarly view of the 1950s and 1960s, which attributed the underdevelopment of Third World states primarily to a state's *internally* "backward" social structure, norms, and values (e.g., McClelland, 1961; Hagen, 1962; Pye, 1962; Moore, 1979). These structural analysts have gone on to demonstrate that asymmetric relations of trade and power *between* states, regions, and interest groups have affected the course of Third World development much more than internal backwardness.

This "political economic" approach has adherents throughout the world, especially in Canada, which has been extensively involved in international, interregional and intergroup dependency networks (Richardson and Wellman, 1985). A number of research groups with varying interests have contributed to this work: For example, "dependency" and "world-systems" analysts have studied how international terms of trade affect the internal structures of dependent countries (Frank, 1969; Wallerstein, 1974; Friedmann and Wayne, 1977; Friedmann, 1978, 1980, 1982, Chapter 11; Skocpol, 1979; Wayne, 1980; Delacroix and Ragin, 1981).

This work has led other structural analysts to consider more fully how power over access to resources affects relationships and to examine linkages between large-scale units as well as between persons. The reciprocal effect has been weaker. Whether through ignorance or distaste for quantitative reasoning, few "political economists" have used structural analytic tools to examine relationships between states and interest groups (see Berkowitz, Chapter 10; Friedmann, Chapter 11; Tilly, Chapter 12; White, Chapter 9). Yet the structural analytic approach shows particular promise for Marxian-informed studies of how power-dependency networks are associated with modes of production, consistent with Marx's injunction that class relationships be analyzed in structural rather than categorical terms (Godelier, 1978; *Insurgent Sociologist*, 1979).

The structural alternative

Structural analysis is more than a set of topics or a bag of methodological tricks with a new mystifying vocabulary. It is a distinctive way of tackling sociological questions that provides a means to the end of taking social structure seriously. In this section I present five general principles that together substantially guide structural analytic work in a wide variety of substantive areas.

Structured social relationships are a more powerful source of sociological explanation than personal attributes of system members

Many mainstream sociological studies treat social structure and process as the sum of individual actors' personal attributes. These attributes, whether derived genetically (e.g., age, gender) or socially (e.g., socioeconomic status, political attitudes), are treated as entities that individuals possess *as individuals*. Each is treated as an independent unit of analysis and lumped into social categories with others possessing similar attribute profiles. The method of analysis – be it cross-tabulation, correlation, or more complex multivariate techniques – proceeds by sorting individuals possessing similar combinations of attributes into similar analytic cells, for example, old women of high socioeconomic status who vote Republican.

Such taxonomic analyses group individuals into similar-attribute categories without regard for the structure of relationships in which such individuals are embedded – both internally within groups and externally between groups. For example, "there has been a tendency to examine the capitalist class and the petit bourgeoisie as distinct phenomena rather than as class analysis should demand, in relation to one another" (Clement, 1983: viii). Such analyses inevitably conclude that social behavior is the result of the fact that individuals possess common attributes rather than that they are involved in structured social relationships. Hence, although most mainstream sociologists profess to be studying social structure through attributional analyses, their inherent "methodological individualism" leads them to neglect social structure and the relations among individuals (Coleman, 1958:28). Their so-called structural techniques examine relationships between variables – not social system members. Such analyses, interrelating the personal attributes of discrete individuals, lead to a variety of problems.

1. Attribute analyses treat each social system member as an astructural independent unit. Since analyses of this kind must assume random linkages, they cannot take into account members' patterned connections (Berkowitz, Chapter 18). "But of course individuals do not act randomly with respect to one another. They form attachments to certain persons, they group together in cliques, they establish institutions" (Coleman, 1964: 88). Hence, aggregating each member's characteristics independently obscures or destroys structural information in the same way that centrifuging genes destroys structure while providing information about composition.

2. Such analyses concentrate on the attributes that discrete individuals possess. For example, they treat an inherently structural phenomenon, "social class," as a personal attribute, "socioeconomic status." Yet "it is as useful to tell me that 'power' is localized in the X club of New York as it is to

tell me that my soul resides in my pineal gland; the premise is false ... social vitalism" (Levine and Roy, 1979: 360–1).

3. Many analyses compare distributions and correlations of aggregated categories of attributes. They focus on the causes and correlates of internal variation within a social category, for example, relating socioeconomic status to voting behavior. At best, such analyses use categorical memberships as proxy measures of structured relationships (Friedmann, 1979; Breiger, 1981).

4. When analysts consider a category to be truly relevant rather than a proxy, they expect members of that category to behave in similar ways. However, coordinating ties among category members may be responsible for the similar behavior. How these ties come to exist and function is still open to question. Thus, the artisans of the Vendée did not all rise up spontaneously as the aggregated indignation of thousands of individuals. Rather, ties between local communities and occupational groups structured political activity (Tilly, 1967).

5. If analysts treat only categories and groups as relevant organizational units, this affects the ways in which they analyze ties that cut across category and group boundaries. They must treat such ties as marginal, when in fact the category or group may be truly irrelevant to the functioning of ties (Berkowitz, Chapter 18). For example, terming migrants "marginal" may well ignore their concrete urban relationships, while unduly positing attachments back to ancestral villages.

6. Aggregating individuals' attributes encourages analysts to interpret social behavior as a normatively guided phenomenon. The aggregation process has destroyed information about structural linkages but retained information about internalized norms. Analysts seize upon these norms to explain social behavior (Erickson, Chapter 5).

7. Normative interpretations lead analysts to look for behavior that is prescribed or common among category members. They either do not recognize other kinds of behavior or label it as deviant. Yet it may be deviant only because analysts persist in misidentifying it with a categorical reference group.[6]

These observations lead structural analysts to wonder if "the stuff of social action is, in fact, waiting to be discovered in the network of interstices that exist outside the normative constructs and the attribute breakdowns of our everyday categories." To find out, analysts "must aggregate (social) regularities in a fashion consistent with their inherent nature as networks" – that is, they must group individuals by equivalent structural location rather than equivalent categorical memberships (White, Boorman, and Breiger, 1976: 734).

People belong to networks as well as to categories. Structural analysts believe that categorical memberships reflect underlying structural relationships, that is, patterned differences in the kinds of resources with which they

are linked. They do not treat social class, for example, as a set of statuses occupied by members of a population, but as a summary label for economic relations of power and dependency (Wright, 1977, 1980).

> This shift in perspective markedly affects analysis: Once we assume that the unit of analysis is ... a "world system" and not the "state" or the "nation" or the "people" ... we shift from a concern with the attributive characteristics of states to concern with relational characteristics of states. We shift from seeing classes (and status-groups) as groups within a state to seeing them as groups within a world-economy. (Wallerstein, 1976: xi)

Norms emerge from location in structured systems of social relationships

Although many mainstream sociologists do use the structural location of persons to explain their acquisition of norms and values, they still treat persons as individuals acting in response to their internalized norms. They find purportedly sociological regularities when persons who have similar personal attributes behave similarly in response to shared norms. Such explanations, concerned as they are with aggregated sets of individual motives for action, are ultimately psychological and not sociological in character, as they neglect the ways in which variations in structured access to scarce resources determine opportunities and constraints for behavior. These explanations – with their strong echoes of Durkheim's views (e.g., 1893) – implicitly treat social integration as the normal state. They define the relationship of persons to social systems "in terms of shared consciousness, commitments, normative orientations, values, systems of explanation" (Howard, 1974: 5).

In contrast, structural analysts first seek explanations in the regularities of how people and collectivities actually behave rather than in the regularities of their beliefs about how they *ought* to behave. They interpret behavior in terms of structural constraints on activity instead of assuming that inner forces (i.e., internalized norms) impel actors in voluntaristic, sometimes teleological, behavior toward desired goals. Thus, they treat norms as effects of structural location, not causes (see Erickson, Chapter 5).

Structural analysts contend that accounting for individual motives is a job better left to psychologists. They suggest that sociologists should explain behavior by analyzing the social distribution of possibilities: the unequal availability of resources – such as information, wealth, and influence – and the structures through which people may gain access to them. They study the processes through which resources are garnered or mobilized – such as exchange, dependency, competition, and coalition – and the social systems that develop out of these processes (White, Chapter 9).

If norms are to be treated as effects, then how can analysts explain why people behave the way they do? Structural analysts deal with normative motivation in four ways:

1. Some analysts exclude questions of human motivation and concentrate on describing and explaining social systems only in systemic terms (e.g., Boorman and Levitt, 1980; Levine and Spadaro, Chapter 17). One study, for example, modeled systems of social mobility in the American Episcopal church (White, 1970a; Stewman and Konda, 1983). It found the Episcopal ministers' motives for changing positions to be irrelevant to their regular movements through linked "vacancy chains." Another set of studies has mapped a variety of relations among major Canadian corporations, showing links to the state, continuity in intercorporate control over time, and associations between densely knit corporate relations in business sectors and high rates of profit (e.g., Berkowitz, 1980, Chapter 10; Carrington, 1981; Niosi, 1981; Corman, 1983).

2. Many analysts concentrate on analyzing the structural determinants of human freedom and behavior. They do not deny the existence and force of norms, but assume that norms operate only within the constraints and opportunities social structures provide for human behavior. As White argues:

> My personal *values* are voluntaristic individualism. I wish for myself, and others, as much freedom as possible, i.e., as much dignity as possible. This value becomes a mockery without facing the constraints of social structure. Much better a twig of genuine freedom wrung from a tree of constraint than an artificial tinsel forest of freedom....
>
> Most sociology and social science, especially in the U.S., takes the *view* of voluntaristic individualism: basic reality is in individuals' values and choices, social structure being derived therefrom, being merely epiphenomenal.... The fruit of much sociology theory is this deception: social structure must be the sum of individual values so you can define it *a priori* out of your head. Or in recent versions, you can find it by pooling responses of populations of questionnaires.   (White, 1968)

3. Some analysts have placed structural and normative explanations head to head, arguing that structural constraints and opportunities explain social behavior more fully that normative motivation: "Most studies find little or no correlation between an individual's attitudes or normative beliefs and his behavior" (Cancian, 1975: 112; see also Deutscher, 1973). In one experiment, many persons obeyed orders to shock strangers and kin "lethally":

> [Many were] against what they did to the learner, and many protested even while they obeyed. But between thoughts, words, and the critical step of disobeying a malevolent authority, lies

another ingredient, the capacity for transforming beliefs and values into action. Some subjects were totally convinced of the wrongness of what they were doing but could not bring themselves to make an open break with authority. Some derived satisfaction from their thoughts and felt that – within themselves, at least – they had been on the side of the angels. What they failed to realize is that subjective feelings are largely irrelevant to the moral issue at hand so long as they are transformed into action. (Milgram, 1974: 10)

There is a clear contrast between normative and structural studies of "modernization." Normative studies, on the one hand, argue that rural Third World inhabitants go through an attitudinal change of "becoming modern" *before* they participate in urban industrial social systems (Inkeles and Smith, 1974). Structural studies, on the other hand, argue that rural villagers do not migrate to an industrial city *because* of newly adopted modern norms and values, but because previously migrated kin, friends, and neighbors have promised to help them find homes and jobs. Migration is rarely a once-and-for-all, uprooting and isolating experience. Rather, migrants travel and communicate back and forth between their new residences and ancestral homelands (Jacobson, 1973; Mitchell, 1973a; Roberts, 1973; Howard, 1974; Mayer and Mayer, 1974).

4. Some structural analysts explain the uneven distribution of norms in a population as a systemic phenomenon. They argue that people acquire norms, as they do other pieces of information, through network ties. Thus Erickson and Nosanchuk (1984) have shown that the allocation of esteem and disesteem in the Ottawa bridge world has everything to do with the players' behavior in bridge circles and little to do with their location in outside social structures (e.g., work, gender, age). On a much larger scale, argues White (1981, Chapter 9), perceptions of corporations are strongly affected by the kinds of structural niches they occupy in competitive markets. Thus, not only is normatively guided behavior structurally constrained, but the inculcation of these norms, itself, is differentially reproduced through network structures (see Cohen, 1969; Schildkraut, 1974; Brym, Chapter 13).

Social structures determine the operation of dyadic relationships

Many sociologists use another form of reductionist aggregation: They treat dyadic (two-person) interaction as the basic relational unit of analysis (e.g., Homans, 1961; Backman, 1981). They look at factors affecting the initiation, continuation, and loss of ties; the types of resources each dyad member exchanges with the other; and the extent to which such resources are reciprocally exchanged. They disregard structural form, making an implicit bet that they can adequately analyze ties in structural isolation, without

reference to the nature of other ties in the network or how they fit together. Thus, many studies of "social support" see interpersonal help as emerging from multiple duets with separate others (Hall and Wellman, 1985).

Structural analysts point out, however, that social structural features greatly determine the milieux in which dyadic ties operate. For starters, the social structures create relatively homogeneous "foci" within which most individuals choose their dyadic partners: kinship groups, cafes, workplaces, neighborhoods, and the like (Feld, 1981). As a result, "institutionally complete" ethnic groups – supplying a broad range of services to members – tend to retain comparatively high proportions of their members' informal contacts (Breton, 1964).

Once a relationship begins, its structural location continues to affect it strongly. The pattern of ties in a social system significantly affects the flow of resources through specific ties, so that densely knit kinship groups pull apart spouses (Bott, 1957), and densely knit corporate relations bring high profit levels (Carrington, 1981). Many personal community ties persist because the participants are embedded in social structures – kinship, work groups, friendship circles, neighboring networks – that constrain them to continue, and not because either dyad member enjoys being with the other. Indeed, the amount of reciprocity is more evenly balanced in the overall networks than it is among the specific ties within them (Wellman, Carrington, and Hall, Chapter 6).

Structural analysts interpret all dyadic relations in the light of the two individuals' additional relations with other network members. "To discover how A, who is in touch with B and C, is affected by the relation between B and C . . . demands the use of the network concept" (Barnes, 1972: 3). Analysts point out that dyadic relations can only be understood in the context of the structures formed by their linkages. Sociologists cannot discover such emergent properties as coalition formation or network density from the study of dyads. Nor can they study structural effects, such as the positive relationship between interlocking corporate ties and corporate profit levels (Carrington, 1981). This focus on structural form distinguishes structural analysis from other transactional approaches – such as "exchange theory" – which look primarily at structural patterns as they condition dyadic ties.[7]

Even nonhuman social systems have structural properties that are more than the sum of dyadic exchanges. Take the classic barnyard pecking order in which chicken A pushes chicken B away from the food, and chicken B, in turn, pushes chicken C away. Yet the overall social structure of the barnyard is not merely the aggregated sum of such dyadic dominance relationships. At times, chicken C may push chicken A away (i.e., a circle of dominance may prevail rather than a linear hierarchy); at times chicken B and C may form a coalition to push chicken A away from the food. It is the multiple-way

relationships among chickens that make the barnyard pecking order a complex structural phenomenon (Landau, 1965; Chase, 1974, 1980). Like chickens, like people. Tilly (e.g., 1975, 1978) has shown that it is the linked relationships of interest groups that mobilize and structure political activity, and not individual grievances or simple contests between two groups.

Not only does network structure affect dyadic ties, there are times when the larger network itself is the focus of attention. The ties between two individuals are important not only in themselves but also as parts of the social networks in which they are embedded. Each tie gives network members indirect access to all those with whom their alters are connected. Social system members use a variety of direct and indirect ties to search for resources, often transversing several role relationships. Indirect ties link together in compound relationships (e.g., "friend of a friend") that fit network members into large social systems, transmitting and allocating scarce resources.

Thus, several structural analysts have charted the ways in which information – often a scarce resource – flows in structurally patterned ways through networks (e.g., Lee, 1969; Richardson, Erickson, and Nosanchuk, 1979; Delany, Chapter 16). Indeed, sometimes a dyadic success may have negative consequences as a result of the dyad partners' structural location. For example, interpersonal networks efficiently transmit information about job openings to women and subordinate minorities, but the jobs to which they direct persons often are entrapping cul-de-sacs because they are the only sorts of jobs about which network members know (Calzavara, 1982).

The world is composed of networks, not groups

Structural analysts try to avoid imposing assumptions about the boundaries of aggregates. They do not assume that analysis can proceed on the basis of a few discrete categories – such as proletariat and bourgeoisie or core and periphery. They do not assume that tightly bound groups are the fundamental building blocks of large-scale social systems – that communities, for example, are congeries of neighborhoods (Wellman and Leighton, 1979). Indeed, they caution that descriptions based on bounded groups oversimplify complex social structures, treating them as organizational trees, when it is the network members' crosscutting memberships in multiple social circles that weave together social systems (an argument dating back to Simmel).

By starting with networks rather than with groups, analysts are able to study both ties that do not form discrete groups and networks that are, in fact, sufficiently bounded and densely knit to be termed "groups" (Barnes, 1954; Boissevain, 1974; Doreian, 1981, 1982; Seidman, 1981; Seidman and Foster, 1981; McPherson, 1982; Wilson, 1982). What remains problematic is the existence of ramified, spatially dispersed networks of "community ties,"

even when they do not fit within bounded neighborhood or kinship solidarities. Nonetheless, this approach provides a structural basis for assessing the Durkheimian thesis concerning the integration of social systems through complex divisions of labor.

By treating the world as a structure of networks (and indeed, of "networks of networks") one is able to discover complex hierarchies of power, not merely discrete strata (Walton, 1976; Breiger, 1979; Miller, 1980). For example, structural analysis points a way out of the inevitably sterile debate over whether external linkages or internal class relations lead to colonial backwardness (Frank, 1969; Wayne, 1975; Carroll, 1985) by providing a mechanism for comprehending how internal and external relations intersect with and modify each other (see Bodemann, Chapter 8).

Structural methods supplement and supplant individualistic methods

Because of the linked nature of social structural phenomena, structural analysts have had to develop methods for analyzing networks of relationships among social system members. Developments have been most prominent in the domain of quantitative analysis.

Although statistical methods in sociology have grown increasingly sophisticated, they continue to treat individuals as independent units. The very assumption of statistical independence, which makes these methods so appropriate for an powerful in categorical analysis, detaches individuals from social structures and forces analysts to treat them as parts of a disconnected mass. Researchers following this tack can only measure social structure indirectly, by organizing and summarizing numerous individual covariations. They are forced to neglect social properties that are more than the sum of individual acts. Statistical packages such as SPSS (Nie, Hull, Jenland, Steinbrenner, and Bent, 1975) have become a worldview. As one review of social indicator research has noted:

> Social structure, social process, social institutions – all that which goes into a social scientific understanding of society – are all nearly absent. The society whose conditions we are to be informed about is one of atomistic individuals, grouped immutably by sex, race, and birth cohort. Their well-being comes in discrete little packages of disconnected benefits .... It is a world of work without dirty work, where there are unions and strikes, but no industrial conflict. It is an economy virtually without corporations, politics without either political parties or political power.   (Seidman, 1978: 718)

The shift away from methodological individualism toward structural

analysis calls for the development of new relational methods and the redefinition of units of analysis:

> The unit is (now) a relation, e.g., the kinship relation among persons, the communication links among officers of an organization, the friendship structure within a small group. The interesting feature of a relation is its pattern: it has neither age, sex, religion, nor income, nor attitudes; although these may be attributes of the individuals among whom the relation exists. These fundamental definitions prevent structuralists from adopting measurement techniques and methodologies available to other sociologists (e.g., you cannot interview a friendship). A structuralist may ask whether and to what degree friendship is transitive or clustered. He may examine the logical consistency of a set of kin rules, the circularity of hierarchy of communication, or the cliquishness of friendship. We have, as yet, few tools for these tasks and almost none upon which there is universal agreement. Simply defining such terms as degree of transitivity has proven difficult.   (Levine and Mullins, 1978: 17)

To date there have been three associated thrusts in the development of structural methods:

1. Populations and samples have come to be defined relationally rather than categorically.
2. Categorical methods of description and analysis have been replaced by relational methods.
3. Individualistic statistical techniques are being used less and determinate mathematics more to study social structure directly.

Analysts have applied structural methods in a variety of ways. Several have used them to tackle statistical problems of analyzing social structure from samples of egocentric networks (Granovetter, 1976; Erickson, 1978; Frank, 1978; Erickson, Nosanchuk, and Lee, 1981). Some have used stochastic models to study search strategies, arguing that probabilistic judgments are intrinsic parts of social structures (Padgett, 1980; Delany, Chapter 16). Others have developed descriptive measures of social structures based, for example, on their clustering into relatively bound groups or on the extent to which resources diffuse through them (e.g., Shepard and Arabie, 1979; Hubert, 1980; White, 1980; Burt, 1980; Burt and Minor, 1982; Fienberg, Meyer, and Wasserman, 1985; Erickson, Chapter 5; McCann and White, Chapter 14). Thus, researchers have been able to analyze ruling groups in America by describing network clusters and social closeness among large corporations, state authorities, and elites (e.g., Alba and Moore, 1978;

Laumann, Galaskiewicz, and Marsden, 1978; Laumann and Marsden, 1979; Mintz and Schwartz, 1985).

One noteworthy technique, "blockmodeling," inductively uncovers underlying role structures in a social structure by juxtaposing multiple indicators of relationships in analytic matrices. Blockmodeling thus helps analysts to compare actual networks with hypothesized structures (Boorman and White, 1976; White et al., 1976; Arabie, Boorman, and Levitt, 1978; Levine and Mullins, 1978; Sailer, 1978; Breiger, 1979; Light and Mullins, 1979; Snyder and Kick, 1979; Carrington, Heil, and Berkowitz, 1980; Pattison, 1980; Panning, 1982; Heil 1983). Finally, some analysts use mathematical and statistical techniques to trace the course of social structure over time by modeling the interplay of relationships under specific analytic parameters (White, 1970a, b, 1981, Chapter 9; Howell, 1979, Chapter 3; Berkowitz, Chapter 18; Delany, Chapter 16).

These specialized methods have often been the most visible manifestations of structural analysis and may help to explain why structural analysts are often said to be a breed apart. Yet many quantitative analysts have continued to use standard statistical techniques in conjunction with measures of network properties (Wellman, Carrington, and Hall, Chapter 6; Howard, Chapter 7). Similarly, many analysts have continued to obtain powerful results from structurally informed fieldwork and archival research (Roberts, 1973; Lomnitz, 1977; Tilly, 1980; Salaff, 1981; Bodemann, Chapter 8; Brym, Chapter 13). What is distinctive about structural analysis is not the methods used, but the particular ways in which researchers pose questions and search for answers.

Some analytic principles

The principles in the working kits of many structural analysts are a mixture of definitions, assumptions, partially tested hypotheses, and empirical generalizations.

1. *Ties are usually asymmetrically reciprocal, differing in content and intensity.*

More than material goods flow through ties and networks. Flows can include resources such as information about one's environment and resources that are themselves a part of the ties – such as gratification obtained through being liked.

Ties between two persons are usually asymmetric in the amount and kinds of resources that flow from one to the other. Few ties resemble the link between Damon and Pythias – intense, comprehensive, and symmetric. Most are *asymmetric* in content and intensity. There is rarely a strict one-to-one

correspondence between what two persons give to one another (Emerson, 1962; Macaulay, 1963; Kadushin, 1981; Cook, 1982; Wellman, Carrington, and Hall, Chapter 6; Bodemann, Chapter 8).

One study reports, for example, that only 36% of those named as close friends and kin feel symmetrically as close to the persons who named them. The ties they define as "close" are with others. They often have weaker, asymmetric ties to those who name them (Shulman, 1972, 1976). Many persons deliberately limit their claims for assistance from close ties in order to maintain the link (Wellman, Carrington, and Hall, Chapter 6). Yet such asymmetric ties crucially connect network members to each other, and, through the other's additional ties, indirectly connect them to larger social networks.

Although rarely symmetric, ties are usually reciprocated in a generalized way. For example, not only do clients send resources to patrons, but patrons usually send such resources as goods, information, and protection to clients. Further, the power of patrons is partly based on their ties with clients, as the ties themselves are a scarce resource. The ties are clearly not symmetric; nevertheless they are often stable parts of a social system (Wolf, 1956; Bodemann, Chapter 8; Howard, Chapter 7). Among the Ibadan Hausa in Nigeria, for example, reciprocal, asymmetric patron–client ties maintain complex trading networks over great distances (Cohen, 1969). Indeed, the most totalitarian social systems have not been able to function solely through one-way, coercive relations. Reciprocal ties between guards and prisoners permeate prisons and ensure compliance (Solzhenitsyn, 1968; Charrière, 1970).

2. *Ties link network members indirectly as well as directly. Hence, they must be defined within the context of larger network structures.*

The prevalence of asymmetric ties calls into question the voluntaristic assumption that ties exist because two members of a dyad want to interact with one another (Berscheid and Walster, 1978; Evans and Northwood, 1979). In practice, many ties are with network members whom one does not like and with whom one would not voluntarily form a twosome. Such ties are involuntary in that they come as part of the network membership package. They may be ties to persons who must be dealt with at work or in the neighborhood. They may be part of a solidary kinship group or friendship circle, or they may be patron–client ties. Despite their involuntary nature, such ties are often important in terms of the time spent on them, the resources that flow through them, the ways in which they constrain the activities of others, and the indirect access they give to the resources of third parties (Wellman, Carrington, and Hall, Chapter 6; Bodemann, Chapter 8; Howard, Chapter 7).

The possibilities for indirect ties are abundant because each direct tie links

two concrete individuals and not just two roles. Jack and Jill are linked by more than a single pail of water. Although the role relationship between two members affects expectations for behavior, indirect ties are not necessarily restricted to a single role system: Network members typically use a wide variety of direct and indirect ties to search for resources, often traversing several sets of role relationships (Milgram, 1967; Lee, 1969; Travers and Milgram, 1969; Granovetter, 1974; Lin, 1983). For instance, one neighbor often asks another to approach a local politician for help in dealing with city hall. It is the overall *structural context* of network members that defines specific ties (Burt, 1980, 1982; Feld, 1981). Hence, such phenomena as patron–client ties must be treated as local manifestations of larger class structures (Bodemann, Chapter 8).

3. *The structuring of social ties creates nonrandom networks, hence clusters, boundaries, and cross-linkages.*

I start with two weak assumptions. The first is that ties in networks are often *transitive*. If there is a tie from A to B and from B to C, then there is an implicit indirect tie from A to C – and an increased probability of the formation of a direct tie at some time in the future. For example, friends of friends are more than randomly likely to be friends and not to be enemies or not directly linked (Davis, 1970; Holland and Leinhardt, 1977). This transitivity argument can apply to all networks and not just to ones composed of friendship ties. If there are transfer (or brokerage) costs, so that each node falling along a path through a network consumes some of the resource flow, then network members may often find it more efficient to maintain direct ties.

My second weak assumption is that there are *finite limits* to the number and intensity of ties that an individual can maintain (and that most individuals are near these limits). Consequently, most people cannot add many new ties (or add new strands to existing ties) without giving up some of their existing ties (Pool and Kochen, 1978).

Because of transitivity and reciprocity, two linked network members often draw on others with whom they are joined into a densely knit cluster (Abelson, 1979; Cartwright and Harary, 1979; Milardo, 1982). Finite limits operate so that involvement in dense clusters often entails the loss of other ties. Jointly, these structural processes encourage the formation of ties within clusters and few ties across boundaries. A clustered network of this kind contrasts markedly with a *random network* in which each member is equally likely to be linked with each other member, or with a clusterless *even network*, in which each member has the same number of links (Erdös and Spencer, 1974; Holland and Leinhardt, 1979b; Rapoport, 1979; Rytina and Morgan, 1982; Laumann, Marsden, and Prensky, 1983).

Transitivity is a weak assumption. If it were not, the world might well collapse into one giant cluster (Milgram, 1967). Network members often

avoid some direct ties in order to maintain structural autonomy – for instance, when prodigal sons retain links to their parents through their brothers. Some direct ties are structurally difficult to maintain – such as friendships with feuding coworkers. *Intransitivity* helps to separate individuals from one another under these circumstances and to perpetuate discrete network clusters (White, 1966; Bernard and Killworth, 1973; Killworth, 1974).

Clustered networks have paradoxical implications for the integration of social systems: "At the level of the individual, the system is highly connected, for he lies at the center of a dense network of direct and indirect social relationships. At the level of the total system it is highly disconnected, for there are many pairs who have neither direct nor indirect relationships" (Davis, 1967: 186). This sort of pattern may well have been the principal structural reason why the Italian-American residents of Boston's West End were unable to form coalitions to defeat the massive "slum clearance" activities that destroyed their neighborhood in the late 1950s (Gans, 1982; see also Granovetter, 1973).

Yet not all network ties are bound up in clusters. Since both finite limits and reciprocity are weak assumptions, individuals are usually members of multiple social networks, and their ties can connect clusters. Both cross-linked "cosmopolitans" and internally linked "locals" transmit information, influence, and material resources through a network (and its cluster) in complementary ways (Gouldner, 1957; Merton, 1957). Cross-linkages give clusters within a network access to external resources and provide the structural basis for coalitions. Internal linkages within a cluster allocate resources and provide the structural basis for solidarity.

4. *Cross-linkages connect clusters as well as individuals.*

The nodes in a network do not have to be individual persons. They can be sets of nodes, groups, nation-states, or other discriminable units (Friedmann, Chapter 11; White, Chapter 9). The ties in such networks may result from individuals' membership in several clusters or because certain persons have "foreign relations" with other portions of the network. Although the observable ties may often be between individual persons, their importance lies in the fact that they form links between clusters (Bonacich and Domhoff, 1981; Breiger, Chapter 4). "The great promise of the network perspective is that micro and macro can be linked by examining the structural constraints imposed by relational configurations" (Rytina and Morgan, 1982: 90).

Consider the case of interlocking corporate directorates. What is usually more significant is that a director links two corporations, rather than that common board membership is shared by two directors. For example, if the officers of property development companies are also members of the board of a public housing agency, the links may enable the companies to acquire
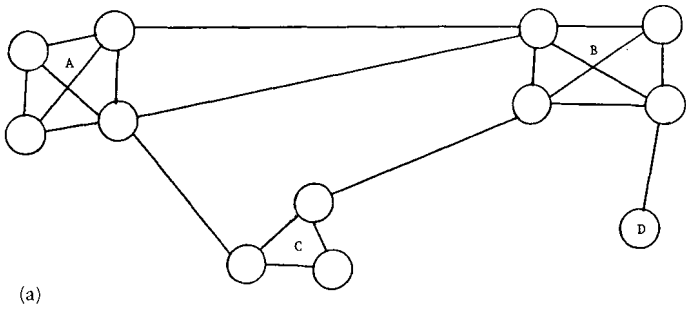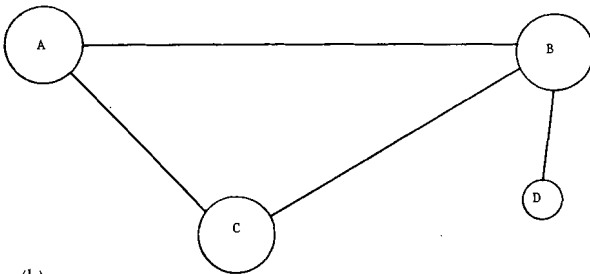
Figure 2.4. A network of networks. (a) Ties between individuals;
(b) ties between network clusters.

"inside" information about public housing activities. When most of the major companies are represented on the public housing board, the links are likely to further the class interests of the industry rather than those of any particular company.

The ties give the managers of the public agency easy access to a "number of 'trusted' private firms to which it can subcontract its work. Here, the relevant links are clearly between the corporate entities, both public and private – although the specific linkages are people, who hold directorships on the boards of both" (Craven and Wellman, 1973: 81; see also Richardson, 1982; Berkowitz, Chapter 18).

When analysts focus on clusters and the ties between them, they are much less interested in internal ties within a cluster. If a tie between two clusters exists at all, then all members of one cluster are linked with all members of the other cluster through internal ties within clusters (see Figure 2.4). The link between General Motors and the Morgan Bank is more important analytically than ties between specific corporate directors or internal ties within the two corporations.

Some recent structural methods take into account the number of ties connecting two nodes or the proportion of all resources flowing between them. Yet some analysts argue that the most important information is whether or not any sort of tie exists between nodes. They suggest that, given the lack of connectivity in most social systems, any connection that facilitates flows of resources within a system is important (White, 1966; White et al., 1976).

    5. *Asymmetric ties and complex networks differentially distribute scarce resources.*

Given asymmetric ties and bounded network clusters, resources do not flow evenly or randomly in a structure. The density of clusters, the tightness of boundaries between them, and the patterns of ties within and between clusters all structure resource flows. Because of their structural locations, members of a social system differ greatly in their access to these resources. Indeed, unequal access to scarce resources may lead to greater asymmetry in ties.

Asymmetric ties between nodes and clusters concatenate into hierarchical networks and engender cumulative differences in access to resources (Davis, 1970). In contrast to ideal models of hierarchies – such as those shown on organizational charts – actual networks often contain ties that transmit resources in two directions as well as complex structures with multiple and cyclical paths. Despite the fact that they are imperfectly hierarchical, actual networks are, however, *ultimately* hierarchical, and their cumulative effect is to distribute resources unevenly.

Researchers have used network-based notions of hierarchy to study the political economic development of nation-states. They have emphasized the importance of observing asymmetric ties *between* states, regions, and multinational interest groups to explain the nature of social structures *within* these states. Some researchers have suggested that the supposed "backwardness" of Third World societies is as much a matter of their ties with other social systems as it is of their internal rigidities (Wayne, 1975; Friedmann and Wayne, 1977). Others have shown the central importance of hierarchical networks in the formation of European nation-states (Wallerstein, 1974; Skocpol, 1979) and in the operation of international commodity markets (Friedmann, 1978, 1982; Chapter 11).

Positions as resources. Incumbency in a structural position is itself a scarce resource because it determines access to other resources. For example, many members of social systems profit from their positions as "gatekeepers" or "brokers." A gatekeeper controlling access to an organization's leader often gains wealth, flattery, influence, use of the organizational resources, and pleasure from exercising control. A broker linking two network clusters often

takes a share of the resources passing through that position. Indeed, a canny broker may impede transitivity by working to prevent the formation of direct links between clusters. Brokers, by virtue of their structural location, cannot be full members of any one cluster. Often their very marginality means that they are not fully trusted because no one cluster can exercise effective social control over them (Goffman, 1963; Marsden, 1982, 1983; Brym, Chapter 13).

Flows through positions. Persons as well as resources flow through networks as they change structural positions. The flows of persons through positions and positions through persons are "duals" (Breiger, Chapter 4). Indeed, positions may experience social mobility when persons with different resources occupy them. Individual moves are part of linked "vacancy chains" (White, 1970a). Old incumbents vacate positions by moving to new ones. Hence, vacancies also flow through systems. Several structural analysts have used the flows of persons through positions to analyze mobility in occupations, organizations, and housing (White, 1970a, 1971; Mullins, 1972; Breiger, 1981; Aminzade and Hodson, 1982; Tolbert, 1982; Stewman and Konda, 1983; Levine and Spadaro, Chapter 17), and demographic constraints on flows of cohorts through social systems (Howell, 1979, Chapter 3; Tepperman, Chapter 15).

6. *Networks structure collaborative and competitive activities to secure scarce resources.*

Structured competition for scarce resources is inherent in social systems. In a system with limited resources, interest groups compete for access to them. In hierarchical networks with asymmetric ties, members must use collaborative or complementary ties to gain access to these same resources. Clustering within a network organizes these ties into more or less bounded coalitions and factions.

Network analysts have worked to show the structural basis of collective political activity. They have demonstrated how acts of collective violence, such as food riots or rebellions, are integral parts of broad contentions for power by different interest groups. Those engaged in collective violence are not the uprooted, disconnected individuals whose putative existence has fascinated "mass society" theorists.[8] On the contrary, those more deeply rooted and more densely knit into contending groups are more likely to be politically active – violently as well as nonviolently (Brym, Chapter 13; Tilly, 1967, 1975, 1979, Chapter 12; Feagin, 1973; Shorter and Tilly, 1974; Oberschall, 1978; Snyder, 1978).

Competition for resources may lead to change in social structure. Coalitions and factions shift in time, and network realignments can have broad systemic consequences (Nicholas, 1965; White and McCann, Chapter 14). For example, when local leaders in India transfer allegiance

from one regional patron to another (in itself an outcome of the alternative sources of rewards available in a network), this causes profound shifts in the social interactions of all their clients, since these clients, themselves, form and relinquish network ties (Mayer, 1966; Pettigrew, 1975).

Although such network realignments redistribute access to resources, they do not cause major changes in the division of labor within a social system. Social scientists have had great difficulty explaining the conditions for such changes, either within single states or larger social units.[9] Since Marx, many have argued that structured competition for scarce resources creates conditions for large-scale social change, but they have not clearly set forth the mechanisms through which these changes take place.

Network modeling techniques may well provide useful tools for studying these mechanisms. Blockmodeling, for example, can provide a set of rules for the transformation of one structure's "image" – a simplified set of role relationships – into another (Boorman and White, 1976; Pattison, 1980). If analysts can integrate such rules with more strictly historical work by modeling the conditions under which system members mobilize to claim scarce resources (Tilly, 1978), the combination should improve our understanding of large-scale structural change.

The state of the art

Structural analysis has become self-conscious and organized. Intellectually, it has moved from a minimalist position, where "network analysis" was seen as a useful supplementary method, to a more maximalist, paradigmatic position, where its central concept – that all social phenomena are best studied through methods designed to uncover basic social structure – is seen as an important new approach to social inquiry. In addition to its critiques of other sociological approaches, structural analysis has now developed a coherent set of characteristics and principles backed up by a sizable body of empirical work. Institutionally, it is bolstered by a professional society, two journals, and frequent conferences.

The most significant substantive achievements of structural analysis have been to pose new intellectual questions, collect new types of evidence, and provide new ways to describe and analyze social structures. Structural analysts have mapped the interlocking ties of corporations, states, and world systems in understandable and useful ways, and they have found abundant evidence of "community" by looking for it in networks rather than in neighborhoods. The structural approach has revealed powerful ways of using consistent analytic frameworks in linking "micro" networks of interpersonal relations with "macro" structures in large-scale social systems.

Structural analytic thought has diffused widely in recent years among

many sociologists (and other social scientists) who do not identify themselves as structural analysts. There is increasing recognition in mainstream work that the proper business of sociologists is the direct study of social structure and not indirect attempts to approach structure through the study of internalized norms, individual actions, and dyadic behavior.

The methodological advances of structural analysis have been impressive. Not only have structural analysts mounted an effective critique of the limitations of individual statistical techniques, they have produced a battery of concepts, methods, and techniques better suited to comprehending structures and relationships. To date, the strangeness and mathematical complexity of their approach has kept it from being widely adopted. Yet, its use is spreading widely, and many structural methods have worked their way into the tool-kits of those initiated into the higher mathematical arts.

The explanatory achievements of structural analysis have been more uneven. Although the general utility of its emphasis on studying social structures depends, to some extent, on one's aesthetic preferences, the specific utility of the more precise principles and methods of structural analysis depends to a greater extent on its success in providing more powerful analyses than other approaches to interpreting social phenomena. Here the results are not yet clear. This is because structural analysts often have not competed directly with other sociologists in explaining the same phenomena. Rather, they have been preoccupied with reformulating basic questions. They have proposed, for example, substituting world-systems analysis for single-state modernization theories, network communities for neighborhood communities, political networks for psychologistic interpretations of collective behavior, and vacancy-chain analyses for individualistic analyses of social mobility.

The current state of structural analysis is probably just a way station on the road to more comprehensive formulations. This chapter has reasoned upward, working from the characteristics of ties toward those of larger networks. By contrast, a more thoroughgoing structural formulation would have reasoned downward, working from the properties of large-scale "networks of networks" to the nature of clusters and ties. For example, such an approach might have systematically analyzed the nature of family and community networks within the constraints of capitalist or socialist economies. Sociologists are just beginning to advance beyond intuitive ways of doing such top-down analyses. To date, the success of their work has often depended heavily on the persuasiveness of their verbal descriptions. Here, too, the facility of structural analysts in posing questions would be enhanced by an increased ability to provide valid and reliable answers.

NOTES

1. Rosch and Mevis, 1975, have argued for the pervasiveness and usefulness of defining categories through "family resemblances." I follow their approach in this chapter by defining "structural analysis" in this fashion. Note that in stressing networks of linkages between categories, the family resemblances approach to cognition is itself analogous to some forms of structural sociology. Examples of recent efforts to provide a standard text are Leinhardt, 1977; Rogers and Kincaid, 1981; Berkowitz, 1982; Burt, 1982; Knoke and Kuklinski, 1982. Bibliographies include: Freeman, 1976; Feger, Hummel, Pappi, Sodeur, and Ziegler, 1982; Scherer, 1983. These works complement the present chapter, as do the discussions by Mullins, 1973; Howard, 1974; White, Boorman, and Breiger, 1976; Laumann, 1979; Berkowitz and Heil, 1980; Burt, 1980; Laumann et al., 1983; Pattison, 1980; Alba, 1981. *Connections,* the informal journal of the International Network for Social Network Analysis (INSNA), and *Social Networks*, a refereed journal, provide contemporary coverage.

2. I mean "British" in the intellectual sense; that is, most of the anthropologists were trained or based at British universities. Many of their origins (e.g., Australia, Canada, and New Zealand) and areas of study (e.g., Africa and India) were of the old and new Empire.

3. For summaries and reviews of this work see Srinivas and Béteille, 1964; Mitchell, 1969a, b, 1973b, 1974, 1979; Bott, 1971; Barnes, 1972; Boissevain, 1974, 1979; Whitten and Wolfe, 1974; Wolfe, 1978. Numerous case studies and analyses exist, e.g., Mitchell, 1956, 1961, 1969c; Gutkind, 1965; Wolf, 1966; Mayer, 1966; Liebow, 1967; Epstein, 1969; Parkin, 1969; Wayne, 1971: 51–2; Kapferer, 1972; Boissevain and Mitchell, 1973; Jacobson, 1973; Roberts, 1973; Mayer with Mayer, 1974; Boswell, 1975; Peil, 1978, 1981; Roberts, 1978; Peattie and Rein, 1979.

4. For example, analysts have mapped the structure of intercorporate relations in America (Levine, 1972; Soref, 1979; Burt, 1982; Mizruchi, 1982; Mintz and Schwartz, 1985); Canada (Berkowitz, Carrington, Kotowitz, and Waverman, 1978–9; Carrington, 1981; Carrol, Fox, and Ornstein, 1982; Ornstein, 1982; Richardson, 1985); Europe (Scott, 1979; Stokman, Ziegler, and Scott, 1985); and the entire western industrial world (Levine, 1984).

5. For studies of urban personal communities, see, Laumann, 1973; Shulman, 1976; Fischer, Jackson, Steuve, Gerson, Jones with Baldassare, 1977; Verbrugge, 1977; Wellman, 1979, 1985; Fischer, 1982; Greenbaum, 1982; Howard, Chapter 7; Wellman, Carrington, and Hall, Chapter 6. For studies of resource access, see Lee, 1969; Griffith and Miller, 1970; Granovetter, 1974; Boorman, 1975; Mullins, Hargens, Hecht, and Kick, 1977; Calzavara, 1982; Lin, 1983; Delany, Chapter 16. For studies of social support, see Gottlieb, 1981; Hirsch, 1981; Hammer, 1983; Kadushin, 1983; Brownell and Shumaker, 1984; Cohen and Syme 1985; Sarason and Sarason, 1985; Lin, Dean, and Ensel, 1986.

6. These seven points are based, in part, on Howard, 1974: chap. 1.

7. See Heath, 1976; Kapferer, 1976; Burgess and Huston, 1979. For work integrating exchange theory into structural analysis, see Emerson, 1981; Cook, Emerson, Gilmore, and Yamagishi, 1983; and Marsden, 1983.

8. For example, Davies, 1962; Kornhauser, 1968; Gurr, 1969. William Ryan (1971) calls such single-unit explanations of American race relations "blaming the victim."

9. For example, the development of the capitalist "world system," Wallerstein, 1974. Also see Friedmann, Chapter 11.

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