CHAPTER 7. OVERVIEW ON THE USE OF NETWORK MODELS (copyright 1992, with revisions 1995)

S.N. Eisenstadt (1961), in reviewing social anthropological contributions to the study of societies wrote:

It is perhaps only the concept of network that to some extent provides a potentially new analytical tool. It clearly describes or points out the existence of some differential interrelation between different people who are not organized in corporate groups; and it may help in the analysis of the relation of different persons, acting in such a network, to different types of social roles and institutional frameworks. (Eisenstadt 1961:209).

Although we are not yet far along toward a set of statements that might be called, formally, "network theory," still network analysis seems very likely to provide highly applicable models in the social sciences. J.A. Barnes (1969), the originator of an important phase of network theorizing, after referring to his own work in Bremnes (1954), to Bott's pioneering study of family relations in London (1955, 1957) and to Adrian Mayer's study of elections in India (1966), wrote:

> These and other reports show that the concept is useful in describing and analyzing political processes, social classes, the relationship of a market to its hinterland, the provision of services and the circulation of goods and information in unstructured social environments, the maintenance of values and norms by gossip, structural differences between tribal, rural, and urban societies, and so on. (1969b:52)

Let us turn to some actual applications. Elizabeth Bott, studying families in London in the 1950's found that the way in which families organized their internal relationships was conditioned by the kind of network in which the family was involved (1957).

Bott (1957) hypothesizes quite straightforwardly that the kind of network in which a family is involved affects in a very direct manner the condition called conjugal role-segregation. There is, to be sure, criticism of Bott's definition, of her measures, of her sample, of her findings, and of the general validity of her hypothesis (Turner 1967, Platt 1969). But from the perspective we take here there can be no doubt about the practical stance Bott takes: "The degree of segregation in the role-relationships of husband and wife varies directly with the connectedness of the family's social network" (1957:60). That hypothesis is a succinct, formal statement of a rather ingenious argument:

What seems to happen is this. When many of the people a person knows interact with one another, that is, when the person's network is close-knit, the members of his network tend to reach consensus on norms and they exert consistent informal pressure on one another, and if need be, to help one another. If both husband and wife come to marriage with such close-knit networks, and if conditions are such that the previous pattern of relationships is continued the marriage will be super-imposed on these pre-existing relationships, and both spouses will continue to be drawn into activities with people outside their own elementary family (family of procreation). Each will get some emotional satisfaction from these external relationships and will be likely to demand correspondingly less of the spouse. Rigid segregation of conjugal roles will be possible because each spouse can get help from people outside.

But when most of the people a person knows do not interact with one another, that is, when his network is loose-knit, more variation on norms is likely to develop in the network, and social control and mutual assistance will be more fragmented and less consistent. If husband and wife come to marriage with such loose-knit networks or if conditions are such that their networks become loose-knit after marriage, they must seek in each other some of the emotional satisfactions and help with familial tasks that couples in close-knit networks

get from outsiders. Joint organization becomes more necessary for the success of the family as an enterprise (1957:60).

Network characteristics are also conceptualized as independent variables in models intended to explain individual behavior. One such study, by Robert P. Scheurell and Irwin D. Rinder (1973) deals with deviancy, specifically "incest offenders." They summarize the process that occurs in incest cases thus:

> The social network structure is not dense enough to provide real support for the segregated conjugal role pattern which is favored by the offender. Lacking external support, the family uses its children to perform some of the household tasks. Among the consequences of this adaptation are decreasing social distance between the father and his daughter who assumes some of these tasks, possible conflict between the man and his wife and between the daughter and her mother over role behavior, an increase in the probability that the daughter and father will turn to one another for support, leading ultimately to an increase in the probability of incestuous behavior. (Scheurell and Rinder 1973:68).

Robert Scheurell and Kathleen Scherdin (1972) discuss in some detail the role of social network analysis in social work. They point out that several studies have used the concept of social network in attempting to understand the etiology of social problems. Frequently, stable social networks have been identified as an influence in preventing or minimizing problems. Disruption of communication patterns is cited by Melvin Kohn (1955) as part of the etiology of mental illness, especially schizophrenia. Berardo's (1970) study of widowers showed that social network involvement tends to impede the onset of senility. Lucius Cervantes (1965) found that teenagers who dropped out of school had fewer network links than those who stayed in school, from which it might follow that peer networks have a positive influence. Similarly, Reeder (1965) found that unmarried teenage mothers had "weak" social networks.

Social network has some obvious effects on work life at every class level. Frequently, people find their jobs through friends and kinsmen. Then, of course, they make friends, and sometimes kinsmen, of their coworkers. Laumann (1973) finds this sort of integration of occupational and social life more characteristic of some status categories than of others. Wolfe (1974) finds some evidence of correlation between certain characteristics of network set and job satisfaction. His respondents expressed greater satisfaction with their jobs when the networks associated with those jobs were composed of links that were characterized by functional specificity, situational contingency, and external sanctions.

According to Scheurell and Scherdin (1972), the use or nonuse of a social service delivery system is partly dependent on an individual's social network. They urge social workers to make use of such knowledge to increase their own efficiency. Three important studies illustrate some of the effects of different kinds of "networks."

Muriel Hammer's (1963) study entitled "the Influence of Small Networks as Factors on Mental Hospital Admission" shows in some detail how different kinds of social structures determine the response made to the behavior of a mentally ill person. And these different responses affect directly the nature of the treatment that will be received.

There is no easy generalization about network effects on whether a person seeks treatment. Donald Finlay (1966) found the "enduring role network" of an alcoholic to be important to the alcoholic's getting treatment. In contrast, a study by Laurence Linn (1967), of the motivation of mental patients to seek help, revealed transitory role relationships as influential, while enduring networks (represented primarily by family) were less so. Apparently, family

members often adjust to the client (or potential client) and are less likely to recognize the need for treatment.

In a fascinating book entitled "Methods of Madness", Benjamin and Dorothea Braginsky (1969) demonstrate quite convincingly that social networks are influential in determining admissions to mental hospitals in a way one might not have expected: individuals who are or have been patients influence their friends and neighbors to join them, almost as if they were going to vacation resort. After presenting considerable evidence, the Braginskys say: "It appears more than plausible to assume that a relatively large portion of admissions to the hospital are indeed friends and enter the hospital together...Entrance to the hospital, therefore, does not necessarily reflect deficiency, helplessness, or societal rejection" (1969:156).

Jeffrey Salloway (1972) discovered, apparently to his surprise, that urban gypsies in an American city receive much better medical care than most observers would expect, largely because of a well-developed network which provides them with sophisticated information and support in dealing with illness threats. While other presumed "disadvantaged" ethnic groups are enduring very low rates of health care in modern American society, Gypsies are getting as much care and care of as high quality as the average American. Salloway (1973) attributes this fact to "the intensive linking of household units with outside sources in a well-developed network system which provided consumers with sophisticated information and support in dealing with illness threats" (1973:132).

When Salloway (1973) tested the more general applicability of network effects on health care, to populations other than Gypsies, he found, as Finlay (1966) and Linn (1967) had previously, that one has to differentiate network characteristics. He finds there is some reason to believe that "friend networks operate as systems sharing current information about health services, while family networks operate more as role support systems" (1973:141).

Such effects are by no means restricted to American society, but are demonstrated in widely different cultural contexts.

Catherine Maclean (1969) and K.N. Sharma (1969) separately found that social network characteristics are important in whether women seek medical help from the traditional folk system or from the modern system of medical practice, in Nigeria and India respectively.

The effects of different kinds of networks on a person's ability to locate the kind of medical services desired is also demonstrated in Nancy H. Lee's (1969) study The Search for an Abortionist, describing a period when such services were under strict legal restriction. Most strikingly, Lee found that persistent use of poorly qualified or expensive abortionists was accounted for by the fact of dense "highly inbred networks" even among women who were unusually open in discussing the problem. The lack of choice for a woman in need of an abortion was due not so much to the absence of doctors willing to perform such services as to the fact that all their friends and acquaintances had only the same information.

Still on the subject of medical care, it is relevant to point out that the network has also been used to help explain differences in the rates at which physicians introduced new drugs into their medical practices. James Coleman, Elihu Katz, and Herbert Menzel (1957) identified three different kinds of networks in which doctors are involved, a friendship network, an advisor network, and a professional discussion network. While each kind of network serves as a field ripe for the spread of medical innovation, the authors report that the three networks have their effects at different stages of the diffusion process:

The discussion network and the advisor network showed most pair simultaneity (diffusion) at the very beginning and then progressively declined. The friendship network shows initially less pair-simultaneity than the other two, but ...appears to reach its maximum effectiveness later (1957:266).

That the dental profession is similarly organized is clearly demonstrated in a study by Isabel Wolock and Edward Wellin (1967). They report a "loosely knit professional and entrepreneurial system" in a New Jersey city, that "is formally organized into two colleague networks," each of which is in some respects "the mirror image of the other. . in that each consists of a core of established practitioners and a satellite group of juniors" (Wolock and Wellin 1967:80). The networks were differentiated largely on the basis of religion: the one involving Christian dentists, the other, in the main, Jewish dentists. Wolock and Wellin do not comment on the influences of such network differentiation on patient care, but one suspects such influences are significant.

In therapeutic professions other than medical ones the effects of the social networks of the practitioners are patently important. Social workers' networks of colleagues and friends influence their attitudes with respect to the problems of their clients in subtle ways that go well beyond differences of formal institutional settings or differences of "schools" of social work. Scheurell and Scherdin (1972) cite several studies of such network effects which have, as they put it, "clinical significance." T.C. Esselstyn (1966), for example, provides considerable evidence that the social networks of correctional workers influence their professional behavior and attitudes toward clients.

Manifestly, the network model of society ought to be applied not only to describe the presence of such "natural" and uncontrolled influences on human service practitioners but also to design actions which take them into account and aim at improving the services.

Scheurell and Scherdin (1972) call for the social case work practitioner to view the client and his problem in relation to his social network. Extending the frame of reference for intervention to include the client's social network has consequences for any clinical therapy in two respects: recognition of the influence of the therapists own social network and recognition of the effect of network in treatment. The therapist's own network influence his/her attitudes with respect to the problems of the clients; also, clients become a part, in certain respects, of the therapist's network, and the latter is involved in the network of the client. In regard to treatment techniques, Scheurell and Scherdin point out that a valid model of treatment might cast the social worker as a network specialist:

> The network specialist brings people with problems together and uses knowledge of the social network to help resolve the problems of people. Since the network specialist is strategically placed and can transmit, filter, receive, code, decode, and interpret messages, and develop coalitions of parts of a network, he provides an important link in the communication channels. All of these functions could serve the purpose of resolving problems. (Scheurell and Scherdin 1972:59).

They go on to say, "It is conceivable that the social work practitioner could become an expert in social networks and dynamically utilize social networks as a broker for directed change in his clients" (1972:59).

The network model has been instrumental in therapeutic work applied to marital problems, family problems focusing on a particularly problematic individual, and other troubling family situations, in an approach certain practitioners have called "network intervention" (Attneave 1969, Attneave and Speck 1974, Ruevini 1975, Ruevini and Speck , Ruevini and Wiener , Speck and Attneave 1973, Speck and Ruevini 1969).

The basic idea of "network intervention: is to help the family mobilize its own social resources (family members, relatives, friends, neighbors) to work toward resolution of problems that have not responded to other, less complicated, methods of treatment. As practiced by the persons named above, network intervention involves a series of face-to-face meetings of the thirty or more persons identified as the network, with a network intervention team of counsellors who plan, develop, and provide impetus for implementing therapeutic strategies.

The decision to use network intervention is based on criteria such as that the family has demonstrated its unwillingness or inability to solve a problem by itself, and that the family members have kinsmen and friends and neighbors whom they can trust and can communicate with sufficiently to call upon for this kind of personal help. Once the decision is made to initiate network intervention, the subject family (or person, presumably) invites all identified network participants to a first meeting, telling them what the problem is and why they are being asked to help.

Ruevini (1975:193-194) summarizes the six phases the group recognizes as the "unfolding process of network intervention" as follows:

(a) Retribalization--an on-going process of reacquaintance and increased awareness that begins with the first telephone call the family makes inviting its members to assemble and continues throughout the meetings;

(b) Polarization--a process that develops primarily as a generational conflict;

(c) Mobilization for action--an effort mounted by active and concerned group members;

(d) Depression--a state characterized by set-back and impasse;

(e) Breakthrough of the impasse;

(f) Exhaustion and elation--a state in which group members experience renewed feelings of hope and a relief from the immediate crisis.

E. Mansell Pattison, a psychiatrist, has used a network model to develop a modality of therapy which he calls "system" therapy in contrast with the traditional model of personal therapy. Instead of intervening in the internal psychological structure of the individual, the system therapist intervenes in the network sets surrounding the individual. By tightening and loosening the affective and instrumental linkages that exist in the network, different options for behavior are presented to the client who will, consequently, behave differently.

Pattison's approach differs from the "network intervention" of Attneave Ruevini, and Speck primarily in that while the emphasis of these later is on mobilizing the network to help the patient, Pattison aims at changing the network itself. Pattison uses Wolfe's concept of "network sets" of various kinds (personal, categorical, action, role system, and field), and he develops further the ideas of Epstein, Mayer, and Boissevain of the concentric zones surrounding individuals (personal, intimate, effective, nominal, and extended). His data suggest that neurotic and psychotic persons differ from normal persons in the number and type of social connections in their intimate network zones. Pattison finds that whereas a normal person has 24 to 27 direct relationships in a fairly connected (60%) set, his neurotic patients have 10 to 12 persons participating in his personal network and the connectedness ratio is only 30%. Still more distinctive, his psychotic patients average only

seven relationships and these are almost entirely connected, being predominantly family members (Pattison 1975).

A study by Christopher Tolsdorf (1976) has important implications for mental health treatment. Comparing psychiatric patients, all diagnosed as some variety of schizophrenic, with a control group of non-patients, Tolsdorf finds network differences very much like those reported by Pattison. The psychiatric patients have smaller network sets, composed of more kinsmen, but even so those sets have a smaller proportion of multiplex (holistic) relationships, and there is more assymmetry in those relationships such that the patients gave much less help (advice, support, feedback) to others than they received.

Tolsdorf's (1976) summary is worth quoting at length here:

> In view of the systemic quality of social networks, the issues described above take on significance in the way in which they interact. By considering a number of issues simultaneously, it becomes possible to identify two contrasting constellations for the two groups of subjects. Specifically, the psychiatric subjects experienced some significant life stress with which they attempted to cope using individual mobilization. When this strategy failed, they chose not to mobilize their networks, relying instead on their own resources, which had already been shown to be inadequate. This resulted in more failure, higher anxiety, a drop in performance and self-esteem, followed eventually by a psychotic episode. The medical subjects showed a variety of constellations, but in no case was the psychiatric constellation replicated. (415)

Findings by Jay Sokovsky and his colleagues (1978) in a study of a single-room-occupancy hotel in New York used as a residence for released ex-mental patients, confirm those of Pattison (1975) and of Tolsdorf (1976). Persons diagnosed as schizophrenic had significantly smaller networks than the nonpsychotic persons, the schizophrenics well below 15 first- order relationships and the nonpyschotics over 20. However, schizophrenics with residual symptoms fared much worse than those without residual symptoms in terms of the proportion of their links which showed their dependence on other persons compared to links which showed them helping others. The schizophrenics without residual symptoms had 16% and 17% such links respectively, while those with residual symptoms had 26% "dependent" links those with residual symptoms had 26% "dependent" links and only 5% outgoing links (p. 14). We agree with the authors that their findings suggest that social networks can have a preventive, and possibly even a curative role (p. 14).

In the 1970s there was at the Florida Mental Health Institute a Community Network Development Project which developed a model treatment program which prepared formerly hospitalized patients for normal community lives by helping them to develop personal support networks useful in everyday life. This has been described in several publications (Gordon et al, 1979; Moran 1980; etc.). That model was later implemented in Pinellas County, Florida, where it was considered a successful treatment program at St. Petersburg's Boley Manor

(*****).

A network model can also be useful in the rehabilitation of persons with recognized problems of dependence on drugs or alcohol. A drug rehabilitation program could intentionally strengthen those portions of a person's network that inhibit drug dependent behavior and at the same time weaken those portions of the network that tend to foster such behavior. In Lynn, Massachusetts, Project Cope uses network sessions modeled after those of Speck and Attneave (1973, etc.) in just such an enterprise (Callan, Garrison, and Zeiger 1975).

In the field of juvenile justice, a program proposed in Milwaukee in 1974 aimed at providing an alternative to incarceration for young people found guilty of a crime, involved, among other techniques, description, observation, and enhancement of these individuals' social networks. C. Meyer and D. Johnson (personal communication 1974) said of their proposal: "By constructing consecutive network models for each individual, at frequent time intervals, specific changes in the quantity and quality of the relationship "links" can be noted. And, by using the network model we feel we can obtain as accurate a description as possible of the person and his interaction with people around him." Although they avoid speaking in terms of "manipulation" it seems to be their expectation that their program will have two kinds of positive effects on the client: (1) by strengthening those portions of his network that inhibit criminal behavior, (2) and by weakening those portions that might tend to foster criminal involvement.

Scheurell and Scherdin (1972) are much more direct in their presentation of the possibility of manipulating social networks: "After understanding the person's social networks, the social worker then must make decisions on how to manipulate the social network in the treatment process" (1972:60). They specify five "areas in which decisions should be made": 1) key links in the network; 2) alternate communication pathways; 3) links across which aid or referrals can pass; 4) links which can help the social worker disengage from the treatment process at the appropriate time. Such understanding, they say, "should allow the social worker to dynamically manipulate both the morphological and interactional characteristics of the social networks as a network specialist-broker in a designed program of treatment" (1972:62). Their ideas are in accord with the intervention" therapeutic work just described.

It was in studies of the migration of rural populations to cities that network analysis got its earliest wide acceptance by anthropologists. Philip Mayer (1961, 1964) has demonstrated the usefulness of network analysis for an understanding of urbanization, in the sense of rural or tribal people's moving to and building their lives in cities. He writes:

The differences between those who migrate and those who stop migrating, while difficult to phrase either in terms of a social structure (classically defined) or in terms of "culture", can be expressed fairly clearly in terms of the network of personal relations. This seems to me so far much the most practicable way to approach the, whether conceptually or in the field.

Other things being equal, a migrant's willingness to stay on in town depends upon how he evaluates the new personal ties he has formed there, in relation to the older ties with persons still in the country. . . .A shift in the balance between within-town ties and extra-town ties--a shift in favor of the former--is what we may call the process of urbanization (1964:24).

But Mayer's study of Xhosa migrants to East London, South Africa, reveals interesting complications that make clear the need for actual studies of the kinds of networks in which people are involved:

> A man who can enumerate a satisfying number of close friends in town is not thereby proven to have become town-rooted. The further question must be asked: What kinds of friends are they, in terms of their own roles and relations? Are they country- oriented migrants themselves? And are they by any chance from the same rural place of origin? There is a possibility that if they are, their association may well reinforce, instead of weakening the migrant's sense that he ultimately "belongs" in his rural home and not in town. They may constitute a particular kind of dense and morally satisfying network in town which makes a man all the less likely to remain there permanently, because it is not really an "urban" network at all, but a displaced section of the rural network. It is the embodiment of the rural pull itself (1961:28).

These findings that Mayer reports from South Africa have relevance for some problems in American urban society. Sociologists have made the reasonable point that urban migrants with already existing primary group contacts and close-knit networks in their new community are slower to establish secondary relations, slower to participate in voluntary associations, and less likely to vote, than migrants whose networks are characterized by less density.

Thus, Granovetter (1973) suggests close-knit networks have the effect of impeding the solution of national problems such as racial discrimination and differential opportunity structures. From Granovetter, but also from Srinivas and Beteille (1964), we get the suggestion of quite general societal effects resulting from the kind of network that exists or is operative in a given situation. Mobilization for collective action seems to require some sort of extended network, so that not only do "close-knit" networks inhibit, but, in a positive sense, "loose-knit" networks are necessary to the establishment of the wider-scale integration that is a necessary characteristic of modern societies. The varied relationships of the international "jet set" provide an extreme example of this sort of development, but nearer to the experience of most of us is the constrast between the "clannishness" of small religious communities and the outward orientation of successful politicians or businessmen.

Related to the close-knit/loose-knit character of networks is the "strength" of the ties of which networks are composed. Granovetter (1973) emphasizes the importance of what he calls "weak ties," relationships characterized by little intimacy, low emotional intensity, and slight commitment of time. Rather than associating weak ties with alienation and social fragmentation as most social theorists have done, Granovetter (1973) points up their positive functions:

> Here, it is asserted that weak ties are indispensable for both individual fulfillment and for social cohesion. The basic postulates follow from the principle that people tied weakly to each other move in different circles; thus the weak tie serves to connect those different circles
> (Granovetter n.d. abstract).

This principle is as applicable to modern societies as it is to traditional ones:

> The most important application of this particular principle may be to race relations. Where integration has succeeded, it has generally been in those urban settings where high density and frequent "public territory" (store, etc.) make weak ties sustainable. Suburbs with no such facilities, on the other hand, are notorious for their failure to develop harmonious interracial living (Granoveter n.d.: 31).

Social network analysis may find direct application in practical politics. An outstanding example is Adrian Mayer's (1966) analysis of electoral processes in the Dewas District of Madhya Pradesh, which shows how the pattern of a political candidate's linkages based on all sorts of criteria is utilized to generate support among or to apply pressure to the various sections of the electorate necessary for success. Using network concepts, Mayer is able to analyze different election strategies, showing that action sets of certain form are appropriate to campaigns of a certain type. After differentiating "hard" and "soft" election campaign strategies as appropriate in different situations, Mayer says:

> Now it is possible to argue that an action-set with shorter paths will be more appropriate to a harder campaign. . . The long-pathed set, on the other hand, would seem to be better for a softer campaign. . . Hence, whether by design or by their previous connection with the ward,

> the candidates' strategies and the pattern of their electoral action-sets can be correlated" (Mayer 19-6: 111).

Research by a student in Milwaukee investigated the social network characteristics associated with different kinds of campaigns in American local, state, and national politics. George Ulrich (personal communication) found the network model useful in this regard, finding in at least one campaign that the network set used in the initial stages of a campaign differs considerably from that activated in the critical stretch, so to speak.

Four related micro-political applications of social network ideas reported in a book entitled Social Networks in Urban Situations are described by the editor J. Clyde Mitchell (1969) in the following terms:

> The contributions of Wheeldon, Kapferer, Boswell and Harries-Jones . . . all illustrate further extensions of the use of social networks in the Barnes tradition. Wheeldon (Chapter V) examines a challenge to leadership in a voluntary association in a Eurafrican community in a Central African town and uses the concept of social networks to show how the established leadership is able to bring pressure to bear upon their antagonists by means of their links through common intermediaries. Kapferer (Chapter VI) analyses a dispute that arises in a processing plant on a mine and shows how the parties in the dispute activate links with their fellows to mobilize support for their own particular point of view. Boswell (Chapter VII) describes how people in three different sets of social circumstances in Lusaka, when they are bereaved, utilize existing links with people to mobilize special help. Finally, Harries-Jones (Chapter VIII) shows how links based on common rural origin, kinship and proximity are used to establish the "grass-roots" organization of a political party in a Copperbelt town (Mitchell 1969: 7).

A potentially useful approach to the study of fission in groups is illustrated by the work of Wayne Zachary (1975). From the mathematical structures known as capacitated networks, Zachary derives a model for representing the flow of political information through a bounded group. In this way, one can identify bottlenecks in the flow and even, potentially, predict the likelihood of a crisis leading to fission. In the particular case Zachary analyzes, each faction selectively passes information through its own local portion of the network, thereby increasing the strength of bonds within each faction and decreasing the strength of any bonds between factions. In a series of crises, the several factions operate with an increasing lack of information about each other, raising the probability of some move resulting in a situation necessitating complete rupture or fission. In the club he studied, "Just as a faction tended to know less and less about the political activity of its opposition, it tended to understand less and less its common ground with the opposition, until even the existence of the club ceased to serve as a basis for units." (Zachary 1975: 35). The value of describing and predicting this process is immense.

Of potential political relevance also is a theory of instrumental social networks recently proposed by Richard A. Thompson (1973). Taking a new look at patron-client structures in general, he notes the significance of clients' having multiple patrons. "A high incidence of multiple sponsorship alliances may have the . . . effect of modifying the distribution of power . . ." (1973: 252). For the individuals involved, strategic use of network links can have meaningful consequences, and Thompson finds that the "upwardly mobile. . . (exhibit a). . . tendency toward the formation of multiple sponsorship alliances" (1973:254).

Richard Emerson's (1969, 1972, 1973, 1976) work on power and position in exchange networks might have been of great practical applicability although he

presented his findings in scholarly, theoretical contexts rather than in applied settings. Beginning from operant psychology, Emerson developed a theoretical model of exchange networks that he tested primarily through laboratory experimentation using human actors (1972) before attempting analysis of historical materials (1974). If his model helps us to understand the power of the Mughul Indian Emperor "from the time of Akbar through Aurangzeb" (1974) it seems likely to be applicable to national and international situations in the modern world.

Moving in that direction, but without such a formal theoretical model, I have argued the usefulness of a network approach for understanding and coping with, the organization of economic enterprise at a supranational level of integration (Wolfe 1963, 1977, and in Chapter 12 of this book). The studies of Joel Levine (1977) of the network-structural relations among large corporations also suggest potential applications to important political-economic problems. Contrary to the common view of such power structures, 797 American corporations are found to be connected by short and redundant paths in a pattern with no key persons, corporations, or elite subsets.

During the 1980s there has been a tremendous growth in the field of networks of corporations internationally and in different nations. Beth Mintz (1987), Mark Mizruchi (1987), are among those dealing with such matters, as are Frans Stokman (1984) and David Smith and Douglas White (1988). Chapter 12 of this book provides more informationa about and some criticisms of these works.

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Still to be added:

(A) material on network models in project planning and management. (J. Van Winkle Study of HRS V, etc.
(B) B's suggestions for integrating the various frontier developments of anthropology.

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Note: Full references to works cited are found in the bibliography at the end of this volume.

CHAPTER 8. USES OF NETWORK MODELS IN HEALTH AND HUMAN SERVICES

(This chapter is based on a paper presented at the Sun Belt Social Network Conference, at the Bay Harbor Inn, Tampa, Florida, on February 20, 1981.)

After a long history as a social metaphor, network has become in the past thirty years the subject of formal theory development and methodological elaboration. Increased public awareness of network concepts has created a demand for their application to the solution of human problems. Network studies have now developed to the point where they can respond to that demand. Network analysis helps us to understand social processes in complex systems.

Among the processes we wish to understand are those relevant to the maintenance of the physical and emotional health of individuals and those social processes by which individuals who suffer physical and emotional disorders can be returned to a healthy state. Recognizing the importance of social milieu to the function of the individual organism, people in the health and human services fields are commonly using the phrases natural support system and social support system, and the phrases "system therapy" and "network therapy" are used by certain clinical practitioners.

Of course, it is not only those concerns about the social milieu of individuals that generate interest in network models in health and human services. The number of service-providers--the agencies and organizations, the clinical practitioners, the counsellors, the mutual help groups--is growing and the complexity of their relations increasing. In the metropolitan Tampa Bay area alone, there are well over 1500 formal organizations that attend to the health and human services needs of the population. It is not uncommon to speak of this kind of conglomeration of service providers as the "health system," the "mental health services system," or the "human services system." How network studies are applicable to this domain is our subject.

William Ratcliffe (1978, 1980) published bibliographic references to almost 250 items on the subject of networks and health alone. Although I expand the subject slightly to health and human services, I easily found an additional seventy-odd references to recent works that address such issues directly. I say recent: probably the earliest in either list is the classic study of the diffusion of innovation among physicians, by James Coleman, Elihu Katz, and Herbert Menzel (1957). Muriel Hammer's, "Influence of Small Social Networks as Factors in Mental Health Admissions" (1963), follows soon after, and then Charles Kadushin's "The Friends and Supporters of Psychotherapy: On Social Circles in Urban Life" (1966). But the vast majority of

network studies are much more recent. And I say address the issues directly: With few exceptions, these reference lists include only works that apply network models to very practical issues, and do not include the many excellent theoretical studies that have developed the theoretical models themselves or the methodology of network analysis.

Why such rapid growth in the literature on social networks and specifically on the application of network models? Application of network models to health and human services had to await the development of theory and methodology in the social sciences. Network analysis is popular now in part because it is possible now. Modern electronic data processing and modern forms of mathematics make feasible the pursuit of theoretical concerns that social science had not dealt with satisfactorily: relations rather than things, process rather than form, generative rather than functional accounts.

The relative simplicity of the title, "Uses of Network Models in Health and Human Services," masks a complex subject matter that can be cross-cut in a number of ways. Different kinds of network models can be applied at various levels to different domains of the general universe of health and human services.

The phrase, "different kinds of network models" refers to recognition that "network analysis" is not just one thing. Network thinking can take several directions, those introduced in Chapter 3. One direction involves visualizing a social network as the aggregate of links among persons, another conceiving a social network as a structure of relations, and a third seeing a network as a system through which resources flow. Each of these were elaborated in Part II.

The second set of contrasts that contributes to the complexity of our topic is that any of these network models can be applied to any of the several problem areas of health and human services. I hesitate to list these for fear of belaboring the obvious, but sometimes we need to be reminded of what faces us. Network models are applicable, for example, to each of the elements of a health systems plan such as those listed as headings by the Florida Gulf Health Systems Agency (1981): community health promotion and protection, prevention and detection, diagnosis and treatment, habilitation and rehabilitation, maintenance services, personal health care support, and enabling services (including planning, research, resources development and regulation). I won't go into such detail in all the human services, but anyone should recognize that there are such problem areas in mental health, alcohol and drug abuse services, family services, developmental services, dependency services, delinquency services, criminal justice, social and economic services, employment and training, and on and on. Network models can be and are being fruitfully applied in

all these problem areas.

As for the third set of contrasts, it is important that we recognize explicitly that network models are applicable to various levels of each system we address. We do analyze networks of individuals, of course, but we also analyze role networks, intraorganizational networks, interorganizational networks, and we can analyze activity networks of the activities of individuals or of the activities of corporate groups or other social entities. Here I urge that we not merely nod agreement, paying passing homage to a micro-macro problem. We should pause to consider the importance of differences of level, for these differences are the source of our major unresolved dilemmas. It is important that network models have the possibility of contributing to their solution.

In social situations, as in "biological ones, a whole is truly more than the sum of its parts. A family is more than its separate members: a service organization is more than its components. This is so because of the relations among those parts. Network models can recognize this quality of wholeness better than other theoretical models largely because any network model begins with elements and their relations. Network analysts are not condemned to studying large populations as if they were undifferentiated statistical aggregates. Instead, we can keep hold of the internal variation that can be expressed as local components of the whole system. This ability is, I believe, crucial to the understanding of any change in complex systems. And, I also believe, it makes possible the description and perhaps the explanation and even prediction of the processes by which new social forms are generated. How does a set of persons organize themselves for action, and then form a group which then takes on what appears to be a "life of its own"? How do corporate groups through their mutual interactions generate a new activity set at a wider system level that is "governed" by "principles" quite far removed from those that govern the personal actions of individuals? How often do we hear, those of us who work in or near the health and human services, that one ought not blame the individual service provider for the plight of some poor person who has not received needed care--for it is the system that is at fault. The unserved client "fell through the cracks," they say.

I say network analysis has the best chance not merely of revealing how the system is structured, but of finding those cracks and, if applied to such purpose, of designing the ties to fill those cracks.

Because I believe it important for the subject of application of network analysis, I elaborated in Part II the distinction among three types of network models. The rest of this chapter makes use of that distinction. The first of these three

models I called "network as the aggregate of links, the second I called "network as generated structure;" and the third model I called "network as a flow process." The differences can be illustrated by the examples of Figure 8.1.
[See Figure 3.1]

Figure 8.1. Graphic Representation of Three Types of Network Models.

The three models differ in important ways, requiring different mathematical algorithms for their analysis, but they are all rather recent formulations by social scientists. All three network models are consistent with a thirty-year trend in social theory toward concern with relations rather than things, process rather than form, elementary phenomena rather than institutions, and generative models rather than functional ones. All three network models also seem to be expressions of the empirical experience of ethnographic fieldwork in complex urban society where transactions among individuals are less constrained by established customary relations. And all three models tend to take advantage of modern electronic data processing and modern forms of mathematics that have become available only in recent decades and are still developing.

Network as an Aggregation of Links

Those who use "network as an aggregation of links" often focus on the set of links surrounding a person, and describe that personal network set in terms of the characteristics of the links which comprise it. By far the most literature on networks in health and human services uses this relatively simple model. The previously mentioned classic study of Coleman, Katz, and Menzel (1957) used such a model in identifying different kinds of networks which influence differentially the decisions physicians make about the introduction of new pharmaceuticals. The network differences were not necessarily structural or flow-related, but were differentiated because of the kinds of relationships of which they were constituted: a friendship network, an advisor network, and a professional discussion network.

While current literature often involves more complicated variables, much of it uses the same basic model. As one example chosen from many, Christopher Tolsdorf (1976) reported network differences between psychiatric patients (all diagnosed as some variety of schizophrenic) and a control group without psychiatric problems. Tolsdorf found the psychiatric patients to have slightly smaller network sets, composed of more kinsmen but with a smaller proportion of multiplex (holistic) relationships, and more asymmetry in those relationship such that the patients gave much less help (advice, support, feedback) to others than they received.

A little later, Pattison, Llamas, and Hurd (1979) published some data comparing networks of "normals" (as we who are not patients or addicts are called in much mental health literature) with networks of various kinds of troubled persons, showing heroin addicts and alcoholics to have networks skewed in ways similar to those of psychotics.

Figure 8.2. Mean distribution of persons in intimate psychosocial Networks.

Such a simple model, which in fact barely warrants being called a network model at all, has considerable therapeutic and clinical relevance. Robert Scheurell and Kathleen Scherdin (1972) have put the general case well ten years ago in an article entitled "Social Network Analysis: A Salient Approach for Social Work." Extending the frame of reference for intervention to include the client's social network has consequences for any clinical therapy in two respects: recognition of the direct effect of the client's network in a treatment program, and recognition of the influence of the therapist's own social network on his/her attitudes with respect to the problems of the client. The therapist becomes somewhat of a network broker.

This kind of model implicitly underlies the "network intervention" practiced by Carolyn Attneave, Ross Speck, and Uri Ruevini (Attneave 1969, Speck and Ruevini 1969, Speck and Attneave 1973, Attneave and Speck 1974, and Ruevini 1975).

This network model is also the base for the therapeutic modality that E. Mansell Pattison (1977) calls "clinical social systems intervention" in contrast with the more traditional personal therapy. Instead of intervening in the internal psychological structure of the individual, the system therapist intervenes in the network sets surrounding the individual.

At the Florida Mental Health Institute the Community Network Development project used a model of this kind to try to develop a support system for mental health clients. This is reported on in an article entitled "Reducing rehospitalization of state mental patients: Peer management and support" (Gordon, Edmunson, Bedell and Goldstein 1979).

Medical researchers in 1996 found what they believed to be "very solid" data supporting "epidemiological research showing that **people with strong social networks live longer"** (John Sheridan, cited in Science, Vol 274, 29 November 1996). This particular study found that people who are more socially integrated are at considerably less risk for catching colds. The results were reported in the Journal of the American Medical Association (JAMA Abstracts - June 25 1997). Excerpts follow:

> Objective: To examine the hypothesis that diverse ties to friends, family, work, and community are associated with host resistance to infection.

Design: After reporting the extent of participation in 12 tlypes of social ties (e.g., spouse, parent, friend, workmate, member of social group), subjects were given nasal drops containing 1 of 2 rhinoviruses and monitored for the development of a common cold.

Participants: A total of 276 healthy volunteers, aged 18 to 55 years.

Results: In response to both types of viruses, those with more types of social ties were less susceptible to common colds.... These relationships were unaltered by statistical controls for prechallenge virus-specific antibody, virus type, age, sex, season, body mass index, education, and race. Susceptibility to colds decreased in a dose-response manner with increased diversity of the social network.

Conclusions: More diverse social networks were associated with greater resistance to upper respiratory illness. (JAMA. 1997;277:1940-1944)

I believe it can be said that this model that I call "network as the sum of links" basically underlies much of the general social support movement which tends to propose that the strengthening of "natural" support networks will make it possible to reduce the costs of formal therapeutic treatment by permitting the deinstitutionalization of mental health patients from hospitals, but also by complementing or replacing much of their formal outpatient care with less costly informal support networks in communities.

Network as Generated Structure

The second formal network model, which I labeled "network as generated structure (Chapter 5 above) involves the location of points, persons or organizations, relative to one another, in multidimensional space. Recall that we are now interested in the relationships among the links, not just the sum or average of their characteristics.

The pages of the journal Social Networks and the bulletin Connections often describe the computer programs which reveal these kinds of structures in data that begin with fairly simple descriptions in matrix form of the existence of individual links or of assessment of some kind of distances between persons or other social entities (CATIJ, Bernard and Killworth 1979; SONET-I, Seidman and Foster 1979; STRUCTURE, Burt 1978; SNAP, Payne, Deans and Mitchell 1979; NEGOPY, Lesniak, Yates and Goldhaber 1978; NETWORKER, White and Sailer 1978). All of these use combinations of graph theory and matrix algebra to discover something like clusters, blocks, or categories, and to calculate

various indices of centrality, or isolation, or brokerage. But users must be wary, for even a measure as intuitively meaningful as centrality can prove to have complicated interpretations, as Linton Freeman (1979) has demonstrated.

Despite problems of measurement and problems of interpretation, analysis of social data using this kind of structural model holds great promise. I am surprised that practical applications have so far not diffused as rapidly as I would have expected, given the theoretical prominence of the structural model. Following are just two examples of applications in the health and human services from the work of graduate students in our Applied Anthropology Internship Project supported by NIMH (NIMH Training Grant #5 T24 MH 14442).

John van Winkle (1979) used Killworth and Bernard's (1974) approach called CATIJ in an analysis of the social organization and communication patterns of the direct services and program sections of the Florida Department of Health and Rehabilitative Services, District VI, in Pinellas and Pasco Counties. Among other findings was that communication networks among the staff seemed to depend significantly on gender, leading to recommendations concerning staffing patterns to avoid disruptive cleavages in the system.

Another example, although it turned out less successfully, is a project in which the applied anthropologist, Karen Bernier, analyzed self-reported network data on women who had recently separated from their spouses. It was her intention to use the STRUCTURE program developed by Ronald Burt (1978), to help to measure network changes attending such separations, hopefully to be able to help the Women's Survival Center to design a program to alleviate the unpleasant aspects of such separations. Those data show clearly that the networks of different persons might appear quite similar in terms of the aggregate number of links and the proportions of these that are family, etc., while they differ markedly on structural criteria such as betweenness centrality, clustering, and structural and regular equivalence. (Bernier 1981, and author's notes on further analysis.)

The Flow Network Model

Our third type of model, the flow network model, detailed in Chapter 6, conceptualizes the network in terms of the flow of something through a set of components. Examples of social scientists who use the flow network perspective include Wayne Zachary (1977), John H. Burgess (1978), Edgar S. Dunn (1980) and Harrison C. White (1973).

Zachary (1977) provides a simple example of this model. He sees a bounded group of persons, members of a karate club, as a network through which information relevant to the club flows.

Since the club tends to be splitting into two factions he hypothesizes that information from the leader of one faction will tend to flow among members of that faction rather than flowing through the entire network including those persons surrounding the leader of the other faction. He conceives of the network, then, as constituted of links, each of which can be said to have a certain capacity to carry information. The capacity of each link, he assumes, is indicated by the number of different contexts in which the two persons linked do in fact communicate.

Given this arrangement and treating it as a "capacitated" network, he uses a labelling algorithm developed by L.K. Ford and D.R. Fulkerson (1962) to locate the "minimum cut" in the network. The minimum cut is like a bottleneck in the flow system, where the flow of information which might pass through from one faction to the other, could be cut off completely by cutting the links which determine the maximum possible flow through the network. What Zachary actually comes up with is a list of persons who are on one side of the "cut" and a list of persons who are on the other side of the "cut." But he gets to that result by using a flow network model.

Another fairly simple example of the flow model is John H. Burgess' (1978) conception of a mental health service system as one in which clients flow from program to program receiving services with greater or less effect (see Figure 3.1,C). His interest is in assessment of the service system in terms of success or failure in the treatment of clients. He reports on a study in Illinois where each agency provided information on the clients moving through the network of services, "indicating the periods during which services were provided as well as the nature and cost of the services" (1978:108). He continues, "total system measures, often difficult if not impossible to obtain in a service delivery system, were available in the form of cycles and longest paths" (p. 108). My own feeling is that with such data on capacity and on flow even more could be done by way of analysis.

As will be discussed in much more detail under the rubric, Network Models of Metropolitan Communities, Part IV, below, I am working with a database that contains information on more than 1500 human services providers in the four-county Tampa Bay region. Our database management system, the Human Services Information System, is capable of handling flow- information not only among those 1500 agencies but through some 500 different services they provide. Without network models to apply, analysis of such a database would be impossible.

The database management system we use permits many-to- many relations among the various records that make it up, so that a true network structure is possible even in the database itself. A brief look at the schema of the Human Services Information

System might prove of interest (Figure 8.3).

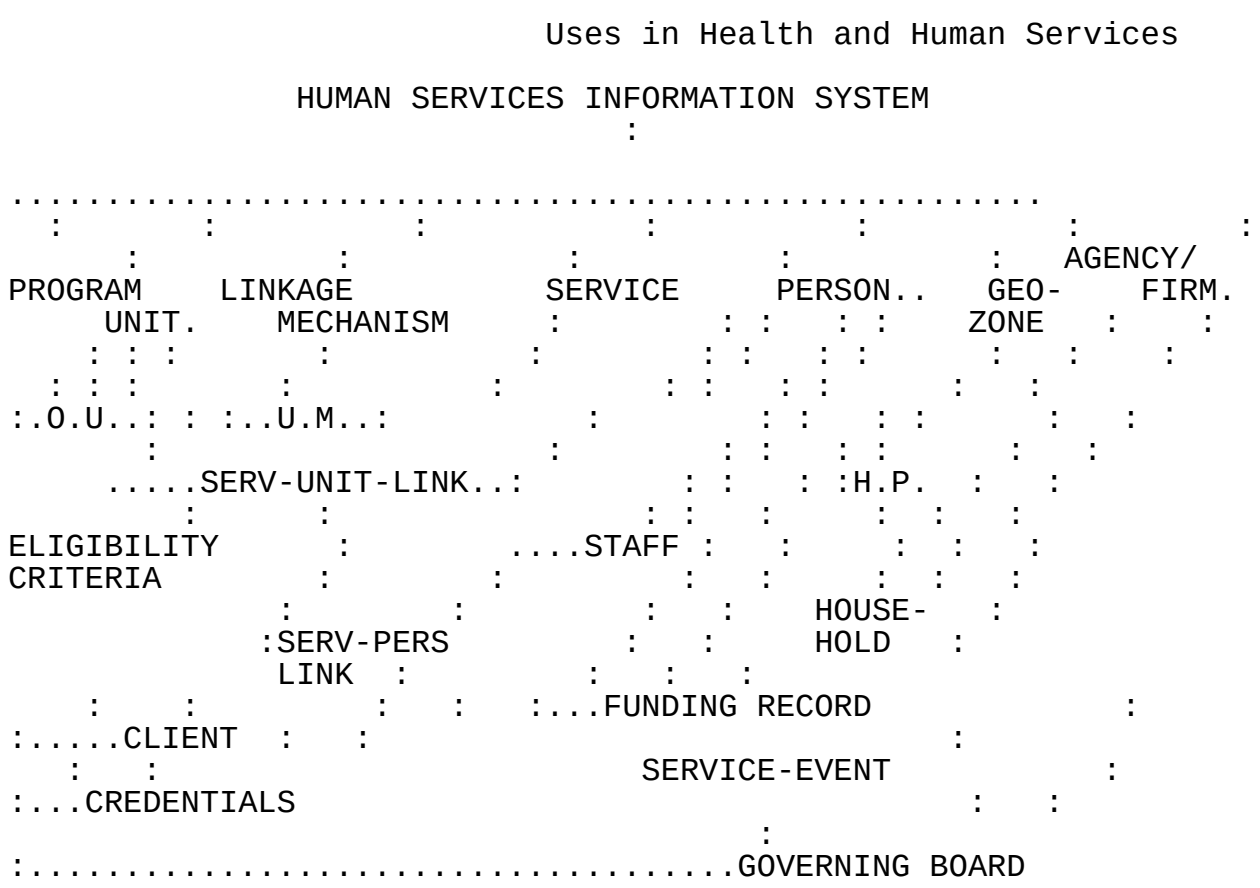

Figure 8.3. Schema for the Human Services Information System. Each node represents a record type and the lines represent links creating sets of records that permit the whole to be handled as a network of information.

As stated earlier, analysis of this human services system as representing the network of a metropolitan community will be presented in Chapters 10 and 11 below.

Unfortunately, some very interesting work using a flow process network model is even more complicated. Edgar Dunn (1980), for example, discusses what he calls now an activity network image of urban structures, the same that he had called a flow network image in 1970. This is not the place to elaborate on his model, which he describes as "a complex of interconnecting, overlapping, overlaying, relational transfers and transformations" (1980:31). It may, indeed, be too complex to map successfully, but not too complex to imagine, and hopefully, not so complex as to defy analysis forever.

Conclusion

In this brief chapter, I have not tried to review all the network analysis that is being applied to health and human services. As I said at the start, that is a large and growing field of action and a large and growing body of literature. My concern here has been to suggest that the uses of network models may expand enormously as we take advantage of the potential of several forms of models that have not yet been fully exploited, namely the structural and the flow process models. It seems to me we are moving in that direction, but too slowly. As early as 1981, a symposium by the same title as this chapter, "Network Models in Health and Human Services," at the Annual Meeting of the American Association for the Advancement of Science contained papers that moved neatly in the direction of greater concern with structure and flow.

Happily, we are seeing more of that kind of discussion, both in the context of applications and in that of theory and method. Alden S. Klovdahl edited as special issue of the journal SOCIAL NETWORKS devoted to Social Networks and Infectious Disease: HIV/AIDS. His introduction begins with a quote from Charles Darwin: "On this tour I had a striking instance how easy it is to overlook phenomena, however conspicuous, before they have been observed by anyone" (Darwin, 1958 [1887], p. 32). Klovdahl's comments on this are highly relevant to us:

> What now appears a natural linking of a social network conceptualization of human populations and the epidemiology of some infectious diseases seemed far from obvious a few years ago. Where epidemiologists once saw 'clusters' of linked cases, we now see regions of social networks in which infected and susceptible persons are connected together by various kinds of social interaction. This is a difference of far-reaching import (1995(17):163).

That issue of Social Networks begins with an idea originated by H. Russell Bernard about using network models and algorithms to estimate hard-to-count populations such as victims of earthquakes and other major disasters, victims of suicide, and, now, AIDS/HIV+ victims. Eugene Johnsen, H. Russell Bernard, Peter Killworth, Gene Ann Shelley, and Christopher McCarty, in "A Social Network Approach to Corroborating the Number of AIDS/HIV+ Victims in the U.S."(Social Networks 1995) use a simple mathematical model of social networks, some elementary social theory, recent estimates of average personal network size in the U.S., and response data from the General Social Survey to take a large step toward improving our ability to count such populations. This could prove a major contribution to the field of epidemiology and in a practical sense, to public health.
See references for all chapters at end of volume.

CHAPTER 9. IMPROVING COMMUNICATION AMONG NETWORK THEORISTS AND PRACTITIONERS

This chapter is based on a paper presented at the Second Annual Sun Belt Social Network Conference February 12, 1982

Review of the "applied" literature reveals that many practitioners who would like to use network models in their work are discouraged from using the most appropriate models because of their own lack of mathematical sophistication. Practitioners need network models that permit precise statements about (1) centrality, in its several types (betweenness, closeness, absolute, relative, point, graph); (2) clustering, in its several types (cohesion, structural equivalence, role equivalence); and (3) flow of resources through arcs of specified capacity. This chapter points out the theoretical and methodological advances toward such useful models and urges practitioners to set aside their doubts and try to work with these advanced concepts. Finally, five suggestions are offered for improving the necessary communication between theorists and practitioners.

Introduction

The title of this chapter implies that there is a problem of communication between network theorists and practitioners, and, possibly, among theorists themselves and among practitioners themselves as well.

Quite regularly, since the 1960's resuscitation of network analysis, following the stimulus provided by people like J.A. Barnes, Elizabeth Bott, Linton Freeman, Muriel Hammer, and Harrison White, commentators have stated or implied that there is a gap between theory and application.

In 1974, Roger Sanjek (1974) concluded a review of the field of network approaches in anthropology by expressing the fear that network scholars would carve out and defend a small intellectual niche, therein producing little more than increasingly trivial results.

At the 1981 Sun Belt Social Network Conference, Jacqueline Scherer credited Douglas Heckathorn (1979) with saying:

> Field studies generate huge volumes of data which cannot be accommodated within existing formal models, and formal models may demand enormous volumes of data which are nearly impossible to gather in the field.

At the same Sun Belt Conference, Michael Migalski's paper called upon theorists to respond more directly to the needs of practitioners. Specifically, he said:

The idea of functional equivalence (contrasted with structural equivalence) is proposed to help bridge the gap between mental health workers and formal network analysis. (1981:4)

At the conclusion of the 1981 Sun Belt Social Networks Conference, the committee that planned sessions for the 1982 conference recognized some such communication problem in scheduling a whole session devoted to the topic, Bridging the Gap between Theory and Application.

This problem is not only a Sun Belt Conference problem, but one felt widely by those interested in applying network models. Everett Rogers and Lawrence Kincaid (1981), in their book COMMUNICATION NETWORKS, say: "Unfortunately most of (the) network literature is (1) overmathematized, (2) confusing in terminology and concepts, AND (3) devoid of much application that would aid the understanding of human behavior. Network analysis has been dominated '. . .' by tool makers rather than tool users. The field has been characterized by sophisticated methodologies looking for theoretical problems to answer.

Also, one of the founders of the renaissance in network studies in the middle of this century seems to recognize some problem along these lines. J.A. Barnes spoke of a dialectical relation between, on the one hand, problems posed by the real world, and, on the other, the content of the theoretical armoury we use in trying to cope with these problems.

Personal Interests and Motives

Because I am treating this issue more as a subjective essay than as an objective analysis of the networks of communication among theorists and practitioners, I feel I should provide some idea of where I am coming from myself. Where do I stand, relative to the two poles we presume in this chapter?

In the course of doing rather traditional ethnographic fieldwork in the Congo Basin in the early 1950s, I was struck by the role played by private corporations in the Belgian colonial system. When the independence of the Congo was thwarted in the early 1960s, I saw that the real power in that region of Africa rested in a supranational network of companies and states, and I published papers at that time that were intended to have both a praxis orientation (1962) and a theoretical orientation (1963). I must confess, however, that my idea of a network was not a very formal one.

My next step relevant to network interests came when I was doing a study of the adaptation by urban white families to poverty, a study commissioned by the federal office of economic opportunity, President Johnson's "War on Poverty." In the course

of that study we learned that the poor white neighborhood was not a social community, and that the best way to conceptualize the social environment of these families was as a network of relations which changed through time as the family moved from place to place (Wolfe, et al 1968).

In 1969, at the University of Wisconsin-Milwaukee, I organized a conference on Anthropological Research in Cities, and it took on a heavy network flavor as well as considerable focus on applications. Society for Applied Anthropology, seeing the value of a practitioner orientation as a way of collecting information on various parts of complex societies, which were looking more and more to me as networks themselves, I affiliated more closely with the Society for Applied Anthropology. As secretary of the Society for Applied Anthropology, I participated in the Executive Committee's writing of a definition of applied anthropology, which seems to me relevant to this present question of communication between theorists and practitioners. As published in HUMAN ORGANIZATION in 1975, the statement began:

A piece of anthropological work, a project, study, or manuscript, is in the field of applied anthropology when it goes beyond analysis and explanation of problematic phenomena to deal with issues about the uses that may be made of the knowledge it is helping to accumulate on the subject (Society for Applied Anthropology 1975:370).

These several interests, in applications and in network models, began to come more fruitfully together when I joined the University of South Florida's program as coordinator of internships in applied anthropology. The need to know something about the network of agencies and organizations providing health and human services in a major metropolitan area required a somewhat more sophisticated understanding of networks of that kind. Furthermore, the increasing importance of network models in planning, evaluation, and in direct service provision stimulated me to move further in the direction of formal theory relating to networks, that is, mathematics and computer algorithms for analysis.

In 1980 and 1981 alone, I participated in at least five conferences on applications of network models. There was the NIMH-sponsored conference in Vermont on Networks, Social Support, and Schizophrenia; there was the American Anthropological Association symposium on network models in urban anthropology, and shortly thereafter, a AAAS symposium on network models in health and human services; I was also involved in an American Psychiatric Association continuing medical education course on networks and social support in therapy, and then in a day-long symposium on networks and substance abuse at the 1981 meetings of the Society for Applied Anthropology. At the 1981 Sun Belt Social Network Conference, too, there were several papers of an

applied nature, including my own on the uses of network models in health and human services.

Imbued with the desire to see network models applied in a variety of fields, but concerned that those who were making the applications were not using the best models possible, I took a leave of absence from my regular work in order to spend it at the University of California, Irvine, working with theorists such as Linton Freeman, Douglas White, Kim Romney, and others, hoping I might learn more of the formal theory I felt was needed to improve applications.

Aims of This Chapter

All that I would like to do in this chapter can be summed up in two phrases: (1) to clarify the nature of the communication problems, and (2) to suggest a few steps toward bridging such gaps.

Specifying the Problems

Who are the practitioners and the theorists?

It might be useful to state what I mean by "practitioners". Let "practitioners" be a set of professionals who are at least potential users of network approaches in their own fields. Those fields that come to mind include: communication; education; manpower; criminal justice; health and human services; management; marketing; manpower; intelligence; urban planning. I am afraid the list could go on and on. I should probably explain why I refer here to potential users rather than restricting myself to actual users. The loose idea of network, as metaphor for social system, is getting so popular that almost anybody who has to deal with people and human organizations can easily see their situation as having network aspects. Since that is so, the differences between actual users and potential users become really only a matter of degree not much different from the degrees by which users of network models differ from one another in terms of the formality or informality of their ideas of network.

In a sense, all the kinds of people we are talking about, theorists and practitioners, can be mapped onto a two-dimensional space. One dimension represents the degree to which persons are oriented toward practice or theory. The other dimension represents the graduated differences in the formality of whatever theories they are working with.

Such a conception of our study population permits us to place those who might be relevant to the problem somewhere where we can see them. And it permits us to assess, roughly, the various distances different kinds of bridges would have to span

if the occupants of those positions were to communicate. There should be a place in our thinking for those pure theorists whose mathematical conceptions are highly formal. And there should be a place in our thinking for those wonderful souls who engage in "networking" for their own or their fellows' benefit, persons such as the legendary "Mrs. Dewars" described by Sarason, et al.(1977). Figure 9.1 suggests how such a map might look.

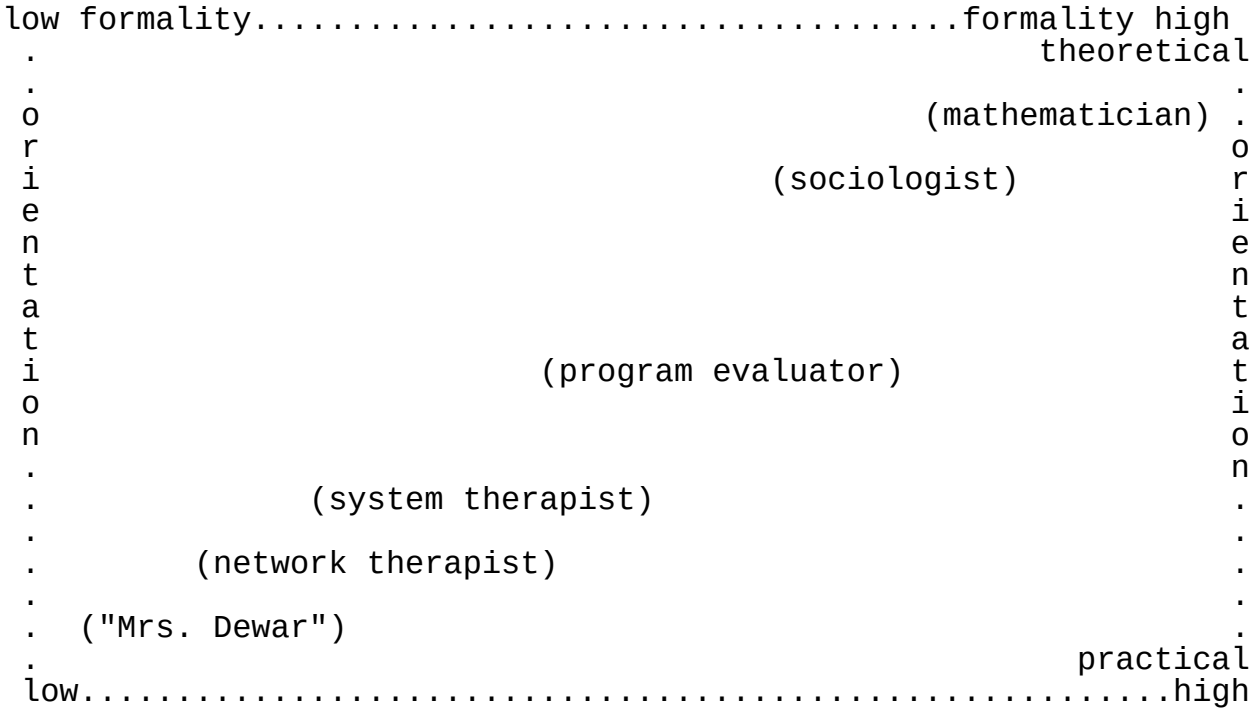

Figure 9.1. Practitioners and Theorists in Two Dimensions.

My general message is that all of these folks could do better whatever it is they want to do if there were more communication among them. Although, I have to add, I do not necessarily believe the communication must be directly between the extremes positions on our map. Some translating bridges along the way might be useful, desireable. I think it would help persons who tend to use "network" as a verb, the family process "networkers," and the network therapists, to know something of the mathematicians' concepts of networks, clusters, structural equivalencies, and such. And I think it would help the mathematician and the social scientist who is a formal theoretician to experience the meaning of relations, or at least to hear or observe those who are engaging in first hand social actions. I know mathematicians are also human beings, but my point here is that the formalisms are not always informed by their social experience.

Harary and Palmer (1973:195) cite C. Northcote Parkinson's statement: "It is not the business of the botanist to eradicate the weeds. Enough for him if he can tell us just how fast they grow."

Practitioners' Lack of Mathematical Sophistication

Even if we restrict our discussion to professionally trained practitioners, it will be found that most of those who are dealing with human social situations are not trained in mathematics. If they have had some mathematics in their education, more than likely they have not been using mathematics in their recent or current work. Especially is it true that they will not have studied nore are they currently using the kinds of mathematics that are now most used in network analysis. The more sophisticated models now call for graph theory and matrix algebra and combinatorics, rather than the statistics with which they are already familiar.

If we look at the students who are training to be practitioners in the fields where network models might prove useful, we also find an unfortunate lack of background in mathematics. Unfortunately, also, their training programs are often devoted entirely to what is already proven useful in their applied field rather than toward future needs. Students in medicine, management, social work, rehabilitation, applied anthropology, are being trained in and given tools for current practice, not for the future of their professions. That has an important bearing on the matter at issue here, because those students who are being trained for research are more likely to be getting the newer mathematics and advanced computer work they need. There is the possibility, it seems, that any gap between theory and practice could well widen to a distance that will be even more difficult to bridge.

So the situation at present seems to be that even those practitioners seriously using a network model in their practice are still not using the "sophisticated armory" that is available.

As I review the papers I have heard at numerous "applied" conferences and symposia recently, and the papers in such collections of works as that excellent one edited by Gottlieb (1981), I am struck by the fact that many who talk a network line are not really taking advantage of the opportunity to analyze network characteristics. Instead, they deal generally with summative characteristics, like the proportion of network members who are kinsmen, etc. These are commonly counted or calculated. One seldom sees, in these applied papers and in the applied literature generally, attempts to measure or compute the more complicated, genuinely structural characteristics, such as:

1. centrality in its several types (betweenness, closeness, etc.).

2. clustering in its several types (cohesion, structural equivalence, role equivalence).

Nor does one see much formal treatment of:

3. flow of various kinds of resources within or through a network.

In those symposia there are occasional papers that treat such concepts, but those are invariably by academicians (for example, Steve Seidman, or Barry Wellman, or Muriel Hammer) and they usually speak of what could be done rather than what has been applied.

The practical work that is reported on, unfortunately, is not using the best tools available. Let me try to give some examples of very good work that could be improved, in my estimation, with more communication between the practitioners and theorists.

Social System Therapy -- Pattison, et al.

Insightful as it has been, and stimulating as it has been to so many in the mental health field, the work of E. Mansell Pattison and his colleagues (1979) has largely been based not on structural characteristics but on size of network and proportion of kinsmen, coworkers, and such that make it up. Gary Hurd (1982) reports on the use in psychiatric diagnosis and intervention of graph theoretic centrality measures. That signals improvement in what they have been calling social system therapy.

Parent-Child Resources -- Tolsdorf

Through his widely cited work on mental patients, Christopher Tolsdorf (1976) has had a significant impact on the dissemination of ideas about using network models in the human services. Recently, he (1981) reported on efforts of the Parent-Child Resource Center in Willimantic, Connecticut, to help families suffering the stresses of divorce and custody problems.

In a marital separation, and especially in a custody battle, a process of mutual blaming often leads to a certain kind of split in the network. Insightfully, Tolsdorf speaks of the role of hindrance and sabotage in a network. As network members have to choose sides, between that of the mother and that of the father, the network comes to be structured into two cliques connected only by the children. The children, caught in the middle, suffer great stress, and respond with a variety of adaptations, mostly unhappy ones. These kinds of situations that Tolsdorf is dealing with provide rich raw material to which network approaches seem highly applicable, but Tolsdorf's "methodology" does not include anything very sophisticated mathematically. (I would like to see Tolsdorf talk to Bill Batchelder about the relevance of Batchelder's formal work on what he calls "Romeo and Juliet" graphs.)

Problem-anchored Helping Networks -- D. Warren

Donald Warren's (1981) paper presented at the AAAS meetings in January, 1981, entitled "Problem-anchored Helping Networks" reports on a survey conducted in the Detroit metropolitan area, with a follow-up interview on a subsample one year later. The problem-anchored helping network is defined as including those contacts that an individual makes with any number of other persons (not necessarily intimates or status equals) with the result that a particular problem or concern or crisis is discussed and advice or help provided. While Warren and his colleagues speak of size, scope, and depth of the helping networks, and they speak of linkages among helpers, it is noteworthy that they do not identify actual helping persons or organizations, but rather only types of kinds of helpers. Would it not be useful to relate these findings to the formal work on structural equivalence (Sailer 1978, Burt 1980) or hypergraph theory (Foster and Seidman 1980)?

Community Network Development -- Edmunson, et al.

In Florida, a Community Network Development project was originated at the Florida Mental Health Institute, to serve later as a model for programs at other institutions such as Boley Manor in St. Petersburg. To my knowledge, none of them have done much with ideas about the structure of the networks they foster, at least not beyond notions of size, density, and proportions of types of members. Their work was presented as a paper at the

AAAS meetings in 1981 (Edmunson and Weinberg 1981), and was earlier described in its wider context by Richard Gordon and others (1979). What they are doing in trying to improve the opportunities for deinstitutionalized mental health clients in the community is extremely important, and since the Florida Mental health Institute has the mission of exporting its pilot programs one would like to see them applying the very best possible theory and method.

Social Support and Adolescent Pregnancy -- Barrera

Manuel Barrera, Jr. (1981:69-96) reports on a study designed to examine the relationship between social support and the well-being of pregnang adolescents, in the hope that ways might be found to help them adjust to a particularly stressful life event. Among a number of measures that were used in this study some were specifically labelled "network indices." These were: (1) total network size; (2) unconflicted network size (the number of people who are directly supportive of one); (3) conflicted network size (the number of people who are sources of unpleasant social interactions); (4) support satisfaction (expressed feeling of satisfaction with the support received from one's network); and (5) need for support (expressed evaluation of how much one felt the need for support).

Barrera reports that the study reveals the importance of distinguishing those network members who are strictly providers of positive forms of social support from those who, in addition, are sources of unpleasant social interactions. The size of the latter group is negatively related to the symptomatology being studied, according to Barrera, who calls for future research relating to that distinction. But I think, rather than merely counting the supporters and the nonsupporters, we would be well advised to use some genuinely structural variables and/or flow network variables to describe the situation as it is and to help design ameliorative interventions.

Networks and the Stress of Separation -- Wilcox

Knowing that marital separation is ordinarily a stressful lifeevent with sometimes long-term consequences for well-being, Brian Wilcox (1981:97-115) examined the size, which he sometimes calls range, and density of the networks among two contrasting groups of women: "those who had experienced considerable difficulties coping with divorce and those who seem to have adapted easily to the demands of marital separation" (102). He found no difference in size of network, but did find differences in density. After the separation, the networks of the women who had unsatisfactory adjustments were more dense, in that a higher proportion of the people they knew knew each other. Also, Wilcox reports that the women who had not made a satisfactory adjustment were those whose pre-divorce networks overlapped heavily with the

networks of their husbands.

While these findings are interesting enough, and can well be used to help plan programs of action, they still do not reflect very much in the way of network structure. More valuable analysis might be accomplished with almost the same data by considering structural measures of centrality, clustering, segregation and so forth.

Social-Community Interventions -- Hirsch

Barton J. Hirsch (1981:149-170) discusses the application of network models to social interventions to promote psychosocial well-being. He reviews several studies by others, including Tolsdorf (1976) and Kapferer (1969), which apparently helped him to focus on certain key variables for his own work. Hirsch speaks of his support network variables as falling into two classes, dyadic variables and systemic variables. Dyadic variables include (1) the types of support that one person receives from another, and (2) whether the relationship is unidimensional or multidimensional (involves one only or several kinds of activities). (i.e., whether it involves one only or several kinds of activities). Hirsch's systemic network variables include, and are apparently limited to, two measures of density, overall density and density of the "nuclear family-friendship boundary" (defined as the proportion of actual to potential relationships existing between nuclear family members, on the one hand, and friends, on the other. (This boundary density has some close similarities to Freeman's (1978) segregation and integration indices, which have been the subject of a some distribution studies which might help in their interpretation.)

Hirsch found that a denser nuclear-family-friendship boundary was significantly related to greater symptomatology, poorer mood, and lower self-esteem, less satisfying socializing, less satisfying social reinforcement, and less tangible assistance. Finally, perhaps surprisingly, the more interaction there was among friends and nuclear family members the more unidimensional were the relations between the woman subject and her friends. Hirsch notes that the network model he uses provides a way for interventionists to evaluate the relations among the several spheres in a person's life. "Significant changes in one sphere ... may well affect other spheres, as well as the integration/segregation of the separate spheres" (167). And, he says, "we should also begin to include network changes as explicit targets of our intervention" (167).

What do Practitioners Need from Theorists?

Let me summarize briefly some of the kinds of theoretical concepts and formal methods that I believe would be most helpful

in showing the value of network analysis. My concern in this regard is that unless some real successes are experienced soon, practitioners will become disenchanted with network models, and so will those who make decisions about expending resources for research and applications. Some theorists, those who believe in pure knowledge, may not fear that their sources of funding will dry up if their theoretical concepts are not put to use, but there is considerable evidence to the contrary. I call attention to a number of statements about the need to demonstrate the usefulness of basic research, written by respectable members of the scientific establishment, prompted by severe cuts in the federal budget for social science at the beginning of the Reagan administration in 1981 (see, for example, pieces in the Social Science Research Council's publication ITEMS (35(3), September 1981), in the SSRC Annual Report for 1980-81, in the American Sociological Association publication FOOTNOTES (9(9), December 1981), and the editorial in SCIENCE written by Kenneth Prewitt, President, Social Science Research Council, Vol. 211, page 659, 13 February 1981).

Criteria Relating to the Effectiveness of Networks

For purposes of applying network models to the kinds of problems we have been talking about, relating to individuals' coping with stressful life events in the context of social networks supportive or otherwise, it seems to me practitioners need models that involve criteria that might prove to be related to the effectiveness of networks. Useful theoretical models then, might include the kinds of concepts I referred to earlier.

Practitioners ought to be able to say that the best network for a given purpose will have:

1. measurable centrality in its several types (betweenness, closeness, etc.) within specified ranges,

2. measurable clustering in its several types (cohesion, structural equivalence, role equivalence) within specified ranges, and

3. measurable flow of various kinds of resources through arcs of specified capacities.

Centrality seems to me to be seriously underutilized by those applying network concepts, even though it has been for years discussed in much of the theoretical literature. I can think, off hand, of three off-hand reasons why some practitioners might not use centrality even if they have read the literature: (1) practitioners may have noticed that the literature presents a welter of different ideas and operationalizations of centrality; (2) practitioners who are working with personal networks may believe centrality has little relevance to their problems because

their data are always centered on a client or subject; and (3) practitioners may fear that calculations of centrality indices are too complicated. If these are the reasons, practitioners should not be deterred.

First, while it is true that the theoretical literature is not univocal, there is an excellent series of articles by Linton Freeman (1977, 1978, 1979, 1980) which throws a great deal of light on the entire issue, differentiating between point centrality and graph centrality, and between centrality based on closeness and centrality based on between-ness.

Secondly, with his introduction of measures of relative centrality, independent of the size of the network, Freeman (1979, 1980) provides the practitioner with indices of the degree to which any person is central to a given network, even his/her own egocentric network. We can readily appreciate that all persons are not equally central in their own personal network, and we can appreciate that such differences may be important. Now we can measure such differences more precisely. With respect to that third point, that practitioners may fear to undertake the calculations necessary to deal with concepts of centrality, it may fairly be said that although the equations Freeman (1979) provides for such measures look quite horrifying to the mathematically naive, algorithms for their calculation are generally, as he says, "simple and straightforward" (1979:225).

There is no reason, now, other than failure of communication between practitioners and theorists, why practitioners cannot use these much more refined ideas about centrality in working with clients or families or organizations they would like to help in some of the ways suggested above. By doing so, the practitioners may find not only that they can do more than they thought they could, but that theorists may be further stimulated to develop still more useful refinements in that area.

A paper by Freeman (1983?) entitled "Centered Graphs and the Structure of Ego Networks" is devoted to developing a way of looking at the pattern of ties in an ego network "that is sensitive to variations in local density and to linkages between dense areas" (p.3). Obviously, this is the kind of work that must be encouraged if network analysis is to prove worthy of support. Susan Greenbaum (1982) studies the effectiveness of strong ties as bridges between dense areas in neighborhood organization. Freeman's formulations might help her immensely to add precision to her studies. Gary Hurd reports on the use of measures of centrality in psychiatric intervention at the Medical College of Georgia. Of course, Gary Hurd, being a graduate of the University of California, Irvine, is hardly a naive practitioner, but he is clearly in the business of fostering applications.

Turning now to the subject we referred to as "clustering", whoever would use network models to accomplish anything in the world should take into account the fact that the actual networks in the context of which they are working are highly varied in their local structure. There are subgroups, cliques, clusters of all shapes and kinds, which surely affect everything that is going on. Certainly, all those who are using network analysis in community organization (Greenbaum, Sarason, D. Warren, among others) are aware of the importance of these structural phenomena. We have seen that most of those are are doing work are personal support systems do presume some sort of differences of this kind. At least, they tend to sort out kinds of persons, such as kinsmen, friends, coworkers, neighbors, professional counsellors, and so on, either because they feel they are intrinsically different from one another or that they interact differently. It would be far better if they would use some empirically based clustering technique, which, as Barry Wellman (1981:192) puts it, "avoids the distortion involved in assuming beforehand that kin form one cluster, friends another, and so on."

Unfortunately, the theoretical literature on clique finding, clustering, blockmodeling, is vast and it is truly complicated. Furthermore, this literature has not yet been subjected successfully to the kind of clarification Linton Freeman accomplished for centrality. Lee Sailer's (1978) article on structural equivalence, and Ronald Burt's (1980) review of formal network models generally, in the Annual Review of Sociology for 1980, certainly helped a lot, but they do not move practitioners toward attempting to use those models. On the other hand, the computer program, STRUCTURE, that Ronald Burt (1978) put together and documented thoroughly in several versions since can quite easily be used by any practitioner who is willing to devote some effort to learning what it does.

A theoretical distinction that should be most useful to any practitioner is that between, on the one hand, clustering persons because they have strong relations with one another and, on the other hand, clustering persons because they relate similarly to other persons. Burt (1980) calls the first approach "relational" and the second "positional". There is little problem with the relational approach, only that one must specify the level of relation that warrants the clustering. There is, however, considerable uncertainty of interpretation when using the positional approach to clustering, based on ideas of structural equivalence rather than cohesion.

A number of papers in the Sun Belt Social Network Conference have dealt with issues of this order. There was in 1982 an entire symposium entitled "Blockmodeling and Beyond." Other relevant papers included: Karl Reitz, "Graph Homomorphisms applied to the definition of roles"; John P. Boyd, "The

Computation of Relations Satisfying Semigroup Constraint"; Miller McPherson, "A Hypernetwork Approach to the Study of Community Organization"; and others.

While the many unresolved theoretical issues in structural analyses at this level may both frighten off potential users and, at the same time, dissuade theoreticians from promoting applications, my own view is that there would be mutual benefits to be gained from practitioners' attempts to use more of these clustering techniques. Applications in actual situations reveal problems in their operationalization or in their interpretation which may lead to subsequent refinements.

I realize that some theorists, and no doubt some practitioners as well, feel that no theoretical formulation should be applied in the "real world" until it is perfected in the laboratory or in some sort of controlled situation. As an empirically oriented anthropologist and a reasonable person having observed real world interventions in a variety of circumstances I am satisfied that we would be quite immobilized if we tried to follow such conservative advice. Nothing is perfect, much less those ideas on which most social and psychological action is based.

As an aside illustrating that interventions are not based on perfect information, I recently heard a psychiatrist addressing other psychiatrists about the relative merits of three kinds of therapeutic intervention for a certain kind of depression: electro convulsive therapy, anti-depressive drug therapy, and all other therapies combined (which he labeled "no therapy"). He had very good data demonstrating the greater effectiveness of ECT. Still, over the past thirty years, more and more psychiatrists have been prescribing antidepressant drug therapy. The reasons are complex, of course, but they have more to do with the ballyhoo of the drug companies than with the scientific demonstration of effectiveness. I do not mean to relate network therapy to this particular problem--except in a general way to note that network interventions are unlikely to do as much harm as some of the many other interventions that are being practiced.

In our applied anthropology program at USF, I have been working with students and colleagues who have used, or are attempting to use, several different clustering programs in small pilot-like projects. In this sense, we have used Killworth and Bernard's (1974) CATIJ program, we have used Burt's (1978a) STRUCTURE program, and we have used a program recently developed by Douglas White and Karl Reitz (1981) which I know by the name "Regular Role Equivalence." I do not claim to have used any of these wisely or well, and I mention them only as illustration that one does not have to be as sophisticated as the developer of a structural analysis program in order to apply the program to a set of data. My argument is that efforts on the part of

practitioners to use such clustering techniques will stimulate communication with theorists and may lead to better, more directly useful, programs.

A third subject where both practitioners and theorists would benefit from more direct communication has to do with models of the flow of various resources in, through, and around a network. In this regard, I think too much of our talk is still quite metaphorical and not sufficiently formal. The important structural models we have been discussing do much better in reference to distances between points than they do in reference to the amount of anything that traverses those distances. We talk about the flow of communication, advice, feedback, and so forth, but I do not believe we have done our best to measure these and to invent concepts that are well interpreted as such.

I am aware that some sophisticated theorists do not feel that flow models need to be very different from structural models, but intuitively I think they should be. I would like to see more practitioners trying algorithms like the Ford-Fulkerson labelling algorithm for flow through a network, used imaginatively by Wayne Zachary (1977) in his analysis of a developing split in a social club. And I would like to see practitioners talking to theorists about whatever inadequacies they feel in this regard. I would like to see practitioners and theorists tightening up all the concepts relating to kinds of resources that can "flow," so to speak. I have been much impressed with the clarification brought to this problem by Uriel and Edna Foa's (1974) SOCIETAL STRUCTURES OF THE MIND. I am not much impressed with the variety of similar categories that I see others using without much attention to their interrelations, in terms either of exchangeability or cognition.

Models of Network Change Through Time

I had wanted to say something about the need for better models of network change through time, but I am afraid that would lead into a vast area that would take us far beyond the topic of communication among practitioners and theorists. It seems everyone recognizes the need for models of process, whether they be cyclical natural processes, through life cycle or whatever, or generative processes that we might come to understand and ultimately use in intervention and action models (Barnes and Harary 1981, Doreian 1981, Hammer 1978, Rice 1981). I am sure you will excuse me for not pursuing all that here.

Communication among Groups of Theorists

Another problem that needs attention is that of communication among theorists. I will not elaborate on this subject here, although I think it important. There are some fascinating network studies of the relationships among different

theory groups, schools, and generations of theorists (Burt 1978b, Freeman and Freeman 1979, Mullins 1978). My inclination is to say that there is more insulation between some of these clusters than is necessary for the development of healthy schools of theory. This problem requires a major study in the sociology of knowledge.

What is to be Done?

Let me conclude with a very brief dissertation on what might be done to correct this lack of communication between theorists and practitioners. Those who attended the Sun Belt Social Network Conference in 1982 heard a well-reasoned keynote address by one of the founders of the current wave of network studies. If I do not misinterpret J.A. Barnes' position too much, he feels that some of the problem I am trying to address is a sort of natural consequence of cycles in any scientific field, oscillating between emphasis on theory and emphasis on real world problems.

Given such a natural history, one logical response might be to relax, waiting for the natural correction of too great a swing in either direction. Another might be to argue against whatever direction is prevalent at a given time.

Still, it seems to me that no matter where the pendulum is and no matter which direction it is swinging, there will be some gap between some theorists and some practitioners, and that both would benefit from increased communication. If we want to reduce that gap, or those gaps, we might do so in five ways that I will mention:

1. Theorists might make an effort to write more clearly.

2. Theorists might be encouraged to engage in some field work.

3. Influential practitioners might be brought more often into the academies.

4. Organize mutual conferences deliberately involving persons from all over the theory/practice map.

5. Foster more network-oriented continuing education for practitioners of all kinds, as is done effectively in medical fields.

Note: See full citations in bibliography at end of volume.