Introduction to Social Network Theory

Charles Kadushin

Chapter 2. Some Basic Network Concepts and Propositions

I. Introduction

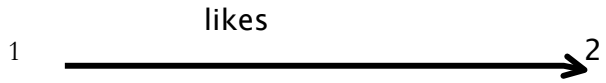
Social network theory is one of the few if perhaps the only theory in social science that is not reductionist. The theory applies to a variety of levels of analysis from small groups to entire global systems. To be sure, there are emergent properties at different system levels, but these are extensions of what can be done at a lower level and not entirely different forms of organization. This chapter will introduce a minimal set of concepts used in network theory. The concepts apply to all levels of networks. Some illustrations and a few elementary propositions will be offered for each concept to suggest that the concept is useful. Further applications of the concepts as well as more complex concepts and propositions will be developed in chapters that are devoted to specific substantive subjects. While all the concepts to be introduced also have formalized ways to measure them, and often several different ways to measure the same concept, the aim of this book is to develop the concept itself and show how it is applied in theoretical statements and in substantive applications. Measurement issues will be noted and referenced, but "how to do it" is reserved for other literature.[1]

1. What is a Network?

A network is a set of relationships. More formally, a network contains a set of objects (in mathematical terms, nodes) and a mapping or description of relations between the objects or nodes. The simplest network contains two objects, 1 and 2, and one relationship that links them. Nodes 1 and 2, for example, might be people, and the relationship that links them might be "are standing in the same room."

[1] Two useful works are (Wasserman and Faust 1997) and (Scott 2000)

There are also directional relationships such as 1 likes 2.

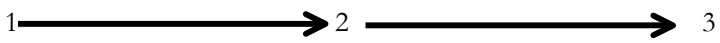


In this simple network, the relationship could be symmetrical or non-directional: 1 and 2 like one another, or their liking is mutual.

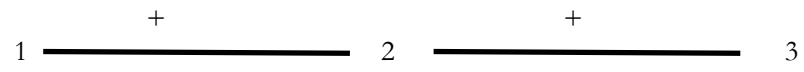
There need not be just one relationship mapped between nodes 1 and 2. For example, 1 and 2 might be in the same room and might like one another. When there is more than one relationship, this is called a *multiplex* relationship.

Aside from their directionality, or lack of it, relationships might be more than the sharing of an attribute or being in the same place at the same time. There can be a *flow* between the objects or the nodes. Liking, for example, might lead to an exchange of gifts. Flows and exchanges can be very important in network theory.

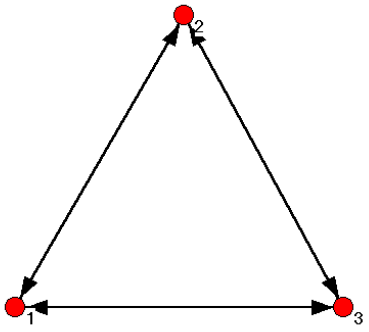
At one level, this list of concepts of relationships between pairs of nodes is now logically complete. But consider a network between pairs that operates via an intermediary node. For example:



1 is connected to 3 via 2. The relationships shown are directional and not reciprocal, but they need not be. They could be non-directional or reciprocal. Consider a non-directional or reciprocal three node relationship in which 1 and 2 like one another, and 2 and 3 like one another. The network connection may be represented by a positive sign:



One can describe the network distance between pairs of nodes in terms of the number of steps or links between them. There are obviously two steps between 1 and 3. But if 1 also likes 3, as shown below, the network is said to be "transitive" or balanced (see below), and in this case all three nodes are directly linked.



2. Sociological Questions about Relationships

Thus far there was no social science involved in the concepts of nodes, pairs, mutuality and relationships. We might have been talking about electrical currents (and indeed there is a branch of network theory that deals with such matters, though electrical circuits tend to be simpler than social networks). But consider. At each level of analysis -- individual, organization, or nation state, for example -- what are the conditions that make it more or less likely that a path will exist between two nodes, that the nodes will have the same attributes, that they will be reciprocally or mutually related to one another, and that triads will be balanced? The answers lie in social theory. We now more formally introduce some hypotheses about these conditions. Further exploration of these hypotheses will be deferred to substantive chapters that deal with them in greater detail.

Social scientists have investigated three kinds of networks: ego-centric, socio-centric, and open-system networks. Ego-centric networks are those networks that are connected with a single node or individual, for example, my good friends, or, all the companies that do business with Wigets, Inc. (the favorite name of organizations studied in business schools). To be considered *networks* these connections must not only be lists of people or organizations, but information must be available about the *connections* between these people or organizations. Otherwise, there is no network to analyze. In popular discourse, especially when social support is discussed, any list is considered to be a network. A person with a large number of good friends whom he or she can count on is said to have a large "network." This network cannot be discussed in social network terms, however, unless we know whether and how these people are connected with one another. It is obviously one thing to have a supporting network in which most people know one another and a very different matter if the people are unknown to one another. Socio-centric networks are, in Russell Bernard's term (personal communication), networks in a box. Connection between children in a classroom, between executives or workers in an organization are closed system networks and the ones most often studied in terms of the fine points of network structure. Open system networks are networks in which the boundaries are not necessarily clear, they are not in a box -- for example, the elite of the United States, or connections between corporations, or the chain of influencers of a particular decision, or the adoption of new practices. In some ways these are the most interesting networks. They are also the most difficult to study.

2.1 Connections

Proposition 1. Propinquity.

> At all levels of analysis nodes are more likely to be connected with one another, other conditions being equal, if they are geographically near to one another.

Individuals are more likely to be friends if they are geographically close (Feld and Carter 1998). A pioneering study showed that in a new housing project for World War II veterans, persons who lived near to one another were more likely to become friends. Persons in corner housing units were more likely to be socially isolated than persons in units that lay between other units (Festinger, Schachter, and Back 1950). A study of networks in the United States of people who serve on several different corporate boards of directors together (these are called (interlocking directorates) found that "Interlocks are concentrated in firms headquartered in the same

locale" (Kono, Palmer, Friedland, and Zafonte 1998). Being selected to serve on boards of directors has more to do with local upper class structure than with simple friendship, and this alerts us to the fact that even when the same network principle applies at different levels of analysis, the dynamics may differ from level to level. Trade between countries, other things being equal, is more likely if the countries have common borders. But, for example, "averaged over all EU countries, intranational trade is about ten times as high as international trade with an EU partner country of similar size and distance." (Volker 2000) Economists tend to define propinquity in terms of cost of transportation rather than the actual number of miles between nodes (Krugman and Obstfeld 2000).[2]

Propinquity can also be more broadly defined as being in the same place at the same time. Studies of elites show that persons are more likely to have a connection, relationship, or friendship if they went to the same prep school at the same time (Domhoff 1967). Of course, they may merely share an "old school" tie (they went to the same school but at different times), in which case we are talking about homophily.

2.2 Homophily

Homophily is defined as having one or more common social attributes, like the same social class. More technically, pairs can be said to be homophilous if they their characteristics match in a proportion greater than expected in the population from which they are drawn or the network of which they are a part (Verbrugge 1977). [For a general review of the topic see (McPherson, Smith-Lovin, and Cook 2001). In developing hypotheses about homophily and the possibility of a connection between pairs one must consider two kinds of causes for pair homophily. Common norms may bring nodes with common attributes together, or the reverse, common attributes and contact may lead to common norms and this holds true for both individuals and collectivities (Burt 1982) p. 234ff. A second cause for homophily is structural location. Two nodes may have the same attributes because both operate in the same arena, and again, vice versa (Feld and Carter 1998).

[2] The caveat of "other things being equal" is well illustrated, however, by the following example: "[T]he Middle East does not constitute a "natural" trading bloc. The region's trade with Turkey indicates that complementarities in production matters more than cultural affinities, or even physical proximity, in promoting trade between countries." (Kleiman 1997)

Hypotheses about homophily are straightforward for individual persons, but somewhat more complex when it comes to collectivities. In general, then:

Proposition 2. Homophily and Connections

The greater the homophily the more likely two nodes will be connected.

Proposition 2a Homophily and individuals

At the individual level, persons are more likely to have a connection, friendship or association, if they have common attributes (Lazarsfeld and Merton 1978). While common norms are promoted through common attributes, so are common attributes likely when association or friendship occurs as a result of co-location and commonly situated activities (Feld and Carter 1998).

Proposition 2b Homophily and collectivities

At the organizational level, whether homophily leads to a greater likelihood of a tie depends on the kind of a connection, as well as the on the industry.

Consider Ford, Chrysler and General Motors as having a common characteristic of being automobile manufacturers and being geographically adjacent to one another in Detroit. If the tie is selling cars to one another, there is unlikely to be a relationship. On the other hand, especially lately, engineers and managers may move from one company to another and this constitutes a tie between the automobile companies. Software firms in Silicon Valle regularly license software to one another and also exchange personnel. Geographic co-location is of course covered under the heading of propinquity, but through the principle of "external economy" it also leads to homophily via structural co-location. External economies, as the name implies, are "the economies that a firm can obtain through the use of facilities or services 'external' to itself" (Hoover and Vernon 1962). This leads to the classic situation of "birds of a feather flocking together" to take advantage of readily available services and hence lower transaction costs. It is no accident that firms that compete with one another and thus have very similar attributes are also geographically close. We will have more to say about this principle when we discuss social circles of organizations.

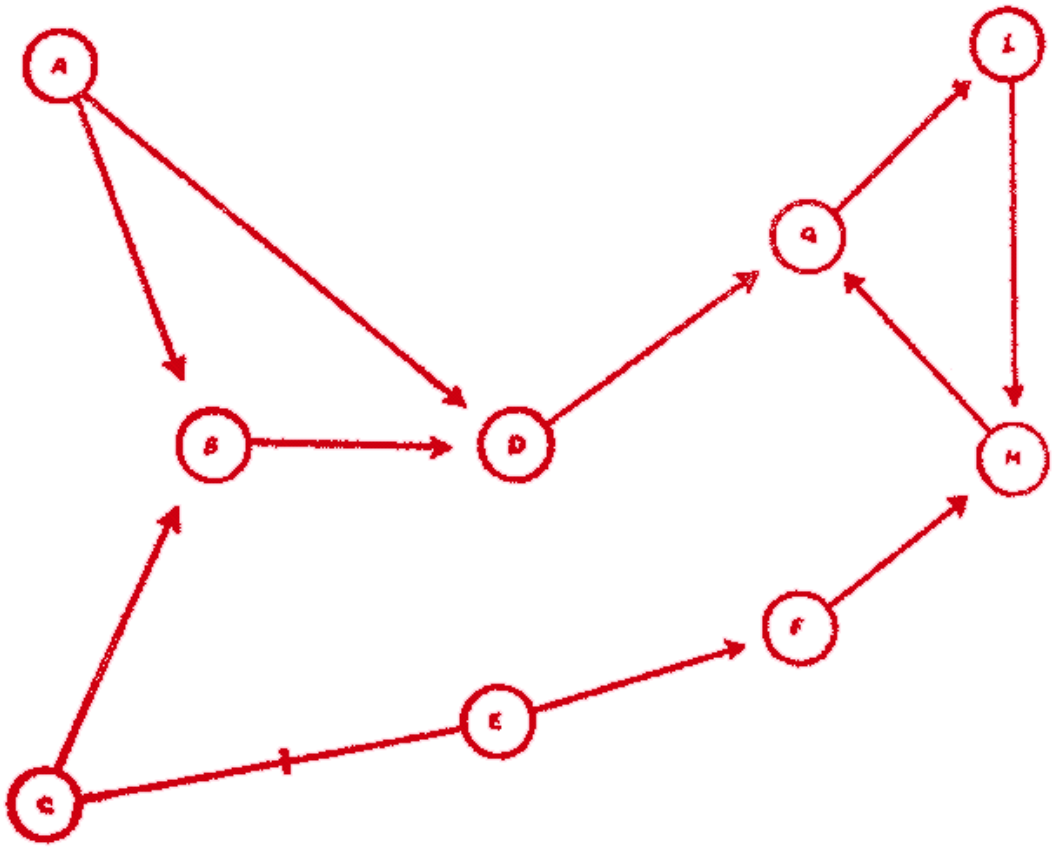
Research on homophily in general investigates the likelihood of homophily and the relationship between homophily and social networks, that is, homophily as a dependent variable (McPherson et al. 2001). Less in evidence is research and propositions on the general *consequences* of homophily, that is, homophily as an independent variable. One important example is the demonstration that attitudes that people have are based in their patterns of relationships (Erickson 1988). Proposition 2c follows from this:

Proposition 2 c. Individuals or groups with homophilous relations are likely to share similar attitudes.

2.3 Distance between two nodes

In general, the concept of network distance involves looking at networks with three or more members or nodes. As the number of nodes in a network grows, so does the complexity of the network. Below is one of the earliest published "sociograms," a diagram of a social network as graphed, obviously by hand, by the originator of "sociometry," Jacob L. Moreno in 1934 (Moreno 1953) p32, reproduced by (Freeman 2000). Moreno originated both terms – "sociogram" – for a social network diagram, and "sociometry" as the study of social networks.

Figure 1: Babies' Recognition of Other Babies



This network was derived from observing babies! The arrow indicates which baby recognized which other baby. The bar shows baby C and E recognizing each other. One measure of distance is, as we noted, the shortest number of paths from one node to the other. A is three steps from I. That is, A to D to G to I. Observe that we said shortest path, because A is also two steps, not one step from D, because A can "reach" D through B. This "diversion" through B could also be counted. We might think nodes are closer to one another, however, if they have a number of redundant contacts as in A reaching D both directly and indirectly. This might make sense in the diffusion of norms, attitudes, or values. One might have to hear the same thing from several different sources until it takes root. (Note of course that we have moved to quite a different plane than the nursery depicted in the diagram above). Then too, in terms of diffusion, we might want to discount a source that is several steps removed because as in the party game of "telephone" things might get garbled as they get passed from one node to another. So one might count the first step as

important, the next step as less important, and so on. Various analytic techniques utilize different measures of distance or closeness.

Proposition 3 a. Distance between any two nodes

The distance between two nodes in a network is determined by four parameters: (1) the size of the first order zone of nodes in the network; (2) the extent to which nodes in the network have overlapping members in their first order zones; (3) barriers between nodes; (4) agency exercised by the nodes.

Distance is essentially the issue raised by Milgram with respect to individuals in his "Small World" studies (Milgram 1967) but it can be extended to apply to all levels of network analysis. The small world problem will be discussed at greater length in a different chapter, but a preliminary explanation of the elementary concepts and principles is offered here.

Definition: The region of nodes directly linked to a focal node is called the first order zone (Mitchell 1969; Barnes 1972). The nodes two steps removed from a focal node are called the second order zone, and so on.

When the first order zone is about individual persons, the term "interpersonal environment" is often used (Wallace 1966; Rossi 1966). [In graph theory this is called the "neighborhood"].

Because it is difficult to study very large networks that might comprise an entire community, city, or even large organization sample surveys have been developed that study some members of the first order zone of a sample of respondents through the use of "name generators." This system produces ego-networks, that is, networks centered about a particular individual. In a widely utilized data set, the General Social Survey in 1985 asked respondents to name up to five others with whom they "discussed important matters." Information about each of these others is sought from the survey respondent on such topics as how they came to know the other, for how long, some of the social attributes of the other and the extent to which each of the others knew each of those named in the first order zone (Marsden 1990). The study might include a number of different name generators and more than five others might be asked about. The network of the first order zone so generated is called an "ego network" and though this might seem to be a limited application of network ideas, the data so generated can be extremely powerful and have been the source of a number of insights into social networks that will be referred to throughout this book.

Proposition 3b. The Size of the Interpersonal Environment

The number of individuals in the interpersonal environment varies from about 300 to 5,000 persons, depending on how this is measured and the type of society in which the focal person is embedded (Pool and Kochen 1978; Bernard, Johnsen, Killworth, and Robinson 1989).

In general, as we will see, in classic village societies "everyone knows everyone else" so the number of steps from one person to any other is minimal. On the other hand, village societies are relatively small and confined so that the first order zone may be no more than about 500 local persons (Boissevain 1974) thus limiting the number of persons who can be directly reached. In contemporary urban societies, professionals and middle class people have a larger first order zone than blue collar and lower class people (Kadushin and Jones 1992). On the other hand in these societies there may be serious barriers across class and ethnic lines making for greater distances between persons in different classes and ethnicities (Wellman 1999). The issue is a complex one and will be taken up below.

Organizations too have first order, second order and tertiary zones, as suggested by the concept "external economy" introduced above. These matters will be discussed when we come to organizations and overlapping circles.

Proposition 3c. The "Small World"

If there were no overlap in people's personal networks, then one could reach the entire population of the United States in two or three steps. (Pool and Kochen 1978).

Suppose everyone in the United States knew exactly 500 other people and that each set of 500 was unique – none of the people you know are known by, say, your brother or sister. Then, the 500 people you know each know 500 unique others, and they each know 500 others, and so on. To the extent that the same people are encountered in the interpersonal environment of different nodes, however – that is, to the extent that personal networks overlap – the distance between the nodes is further reduced. This topic will be analyzed when we discuss social circles of individuals, a concept first introduced by Georg Simmel (Simmel 1955).

Proposition 3d. "Six Degrees of Separation"

> Despite the theoretical number of 2 to 3 steps between any two persons in the United States, experiments done by Stanley Milgram and his students in the 1960s estimated the actual number of steps to be six reached through five intervening persons (Milgram 1967) (Milgram 1969), and (Travers and Milgram 1969)hence the popular phrase, "six degrees of separation."

The alleged "six degrees of separation" does not, however, take account of variation in people's skills at making connections. In Milgram's original experiments most people were not able or were unwilling to make the requested connections

In the experiments, people were asked to reach a target person in a distant city by means of a person most likely to know that person on a first name basis. The experiment worked like chain letter. This number is higher than the theoretical number because there are social structural barriers to network linkages. In the first experiment Milgram reported that links between men and women were much less frequent than same sex linkages. Similarly, there are class barriers.

Hence personal agency or motivation comes into play. Organizations too, vary in the extent to which they actively seek to relate to other organizations and their skills in this respect also vary.

Proposition 3e. The effective distance between nodes.

> While in principle there can be an infinite number of zones, (third, fourth, fifth ... n), the impact of each zone on an individual node declines exponentially. For most purposes, the number of effectively consequential zones is between two and three; that is, whatever is being studied, individuals or organizations, past the third or at most fourth zone objects or nodes have relatively small effects on the focal individual or structure.

In both Burt's diffusion models and his related structural holes models (Burt 1987; Burt 1992) zones past the third or even second are generally not important.[3] Further, the proposition that zones beyond the third zone are not consequential is consistent with "loose coupling" theory that suggests that tight linkages between parts of an organization are not only unlikely, but also inefficient (Perrow 1986). There are some findings in diffusion studies, however, that suggest that even distant nodes, especially if connected to a focal node through a number of redundant paths, can have an effect (White and Harary 2001)

To understand why distant nodes have a limited effect, we have to understand characteristics of whole networks that have not yet been formally introduced. Below we will discuss whole networks but it is useful here to note that (1) networks can be *connected* and (2) networks can be *clustered* or *dense* to various degrees. In a fully connected network, it is possible to reach every node from every other node in the network through a path or connection running from one node to another and in dense or clustered networks, there may be a large proportion of mutual connections, such as friendship circles or people who work in the same part of an organization, etc. Even when an entire network is not dense, the clusters or dense parts of the network may be confined to relatively limited *neighborhoods* or groups.

While the rapidly developing "Small World" theory will be given greater attention in a separate chapter, recent work in modeling small world ideas (Watts and Strogatz 1998; Watts 1999) lends support to the proposition that in large connected networks that are not dense but have highly clustered regions or neighborhoods such as might be typical of friendship or organizational circles or mutual collaboration networks, average shortest path lengths tend to be under 4. This non-intuitive finding requires that only a relatively few nodes within the more dense regions or neighborhoods or circles have connections, called "shortcuts" with other nodes that are not part of the dense neighborhood. This condition is typical of real life situations. Though I am well enmeshed in a given group, I have one friend across the country who is a member of another well clustered group.[4] If only a few groups that are well clustered have this property, then the average path length can be shown to drop precipitously. This model does not depend on the number of persons or nodes known to the focal node, but only on the degree of neighborhood clustering, and the number of shortcuts. The point for

[3] In a technical detail often not noted, this is accomplished by setting attenuation coefficients in Burt's models such that action at a distance becomes less consequential.

[4] Whether this friend is a close friend or someone I do not know very well is part of the "strength of weak ties" hypothesis to be discussed below. The "weak tie" argument is that such bridges are likely to be weak ties, that is, someone I am not close to.

present purposes is that if the average length for an entire huge network (such as the United States) is under four, then the effective neighborhood ought to be less than four, and hence the finding that path length beyond two or three have negligible effect on the focal node.

2. 4 Dyads and Mutuality

Let us return to the simplest situation, a relationship between two nodes, or a "dyad." We have seen that in directed graphs or networks, there can be four possible relationships: none at all – they are not connected, A relates to B, B relates to A, and A and B both relate to one another. We are concerned here with the fourth relationship, reciprocity or mutuality.

Mutuality is a complex topic with an interesting history that requires some exposition before we can inquire into the conditions that foster or deter mutuality. The concept of mutuality implies first, the extent to which relations are reciprocal, that is, involve a give and take between the two parties; and second, the degree of power or asymmetry in the relationship. Nothing ought to be more straightforward than answering the question under what conditions in what kinds of networks can we expect that nodes will have a mutual relationship. But there are statistical complications. A number of indices of mutuality in networks have been developed and one can ask what is the likelihood that a particular network or social system will be more or less composed of mutual relationships than one might expect at random (Wasserman and Faust 1997), Chapter 13. [A recent development is in (Mandel 2000)] The statistical problems are rather severe, however, since even small networks, say of size 10 nodes can have $7X10^{23}$ possible digraphs (Wasserman and Faust 1997), p. 548. The difficulty of imagining what such situations might mean has limited the number of substantive applications. In fact, there are few quantitative studies of reciprocity or mutuality in natural networks though there are several experimental ones. A further difficulty is found in network data. Typically, network data are gathered from recall. While these data are usually good enough to give a general picture, they suffer from inaccurate recall and data collection errors (Bernard, Killworth, and Sailer 1981; Freeman, Romney, and Freeman 1987). Real-time data have other problems – they may be too detailed so that it is hard to see the forest for the trees; they also include happenstance relations that are not stable. The result is that at present there is not enough material available to formulate verified findings on the types of situations in networks that foster mutuality.

There are some interesting qualitative ideas about mutuality, however, and a very large literature. Here I will borrow some ideas from the field of psychoanalysis that has explored in depth issues related to balance and process in dyads. Though the interest of relational psychoanalysis is obviously in the psychology of relationships, more recently in the concept of "intersubjectivity," the matters with which I will be concerned have application to all dyadic systems, whether pairs of individuals, organizations, or countries.

Dyadic system theory goes back at least as far as Rene Descartes in the 17th century (Frie and Reis 2001). The extent to which any unit, or "node" in our terms, can be conceptualized as a solitary individual that is to some extent isolated from the external world is at issue. In Descartes' view, our mind or self-consciousness is uniquely ours and "the world around us is perceived simply as a mirror of our subjectivities"(Frie and Reis 2001), quoting Decartes). The individual comes first, and relationships follow from various attributes of individual units. An opposite view, according to Frie and Reis, is Martin Buber's *I Thou* (1923). Buber contends that "the human being can never be fully understood apart from his or her relation with others." In between there are other positions that grant more or less primacy to individual units. In social psychology Charles H Cooley's "looking glass self" (Cooley 1956) begins as Descartes with the individual but suggests that the self cannot be formed without its reflection from others. More towards Buber's end is George Herbert Mead's symbolic interactionism in which the other is partly contained within the self, for the self cannot achieve its own subjectivity without considering others. The network paradigm denies that any organization or social unit can be understood apart from its relations with other units. The "personality" or core characteristics of any unit are seen as stemming in part from its relations with other units. That is, beyond the attributes of pairs of units, the *pattern* of relationships with the rest of the network helps to explain the nuances of relations between any pair.

From an empirical point of view, psychoanalysts observe that something on a non-verbal level takes place between the analyst and her patient in which understandings, intuitions and feelings take place that cannot be accounted for in easily expressed cognitions, expectations, or formal role relations. There are analogues to this in the developmental experience and the mutual relations between infant and mother long before verbal and conceptual communications emerge. This special "something" is called intersubjectivity. The sources of this nexus, how it should be characterized, what are its bases in the individualities of the members of a dyad, or in the space or process that is created between them, and how the analysts works with intersubjectivity, constitute the discourse about mutuality in psychoanalysis. In network analysis there is a similar finding that relationships are not necessarily articulated, spoken about, or conceptualized by the participants in a network.

For example, the concept of structural similarity: persons and organizations that are structurally similar have been found to behave in similar ways even though there may be no apparent direct communication between the nodes nor is the similarity of their relationships necessarily apparent to them. While this may look like "magic" and the mechanisms that produce these effects seem obscure, the phenomenon is familiar to psychoanalysts in dyadic relations. A nexus that may not involve conscious or verbalized communication in a network as a whole needs to be further explored for how this gets worked out beyond the dyad is not now clear.

Mutual non-verbal communication is often called "empathy" but this term conceals as much as it reveals and needs to be further explicated. Aron (Aron 1996), in describing psychoanalytic interaction, deconstructs the interaction as including:

> The self, or what may be called the ego, as a cohesive separate center of subjectivity as well as an effective agent able to influence the other;
> The self as reflexive in being aware of the self as the object of ones own investigation as well as the object of the wishes and intentions of others;
> In the process of interaction the ego recognizes the other as separate from oneself and as having its own subjectivity, agency and desires.

When all three are present this is called "mutual recognition." Needless to say, this situation is complex and mutual recognition is not always effectively achieved. How to manage interactions so that these three aspects are met is basically what takes place in the socialization process. Direct observation has shown that this occurs very early in infancy and continues to develop (Stern 1985). [Note from Figure 1 above that Mareno (who was a psychiatrist) observed this as early as 1934, though he is not often given credit for this.] All three aspects are not necessarily fully present in many interactions. Some people do not learn very well how to manage all three – often confusing one's own needs and desires with those of the other. One goal of psychoanalysis is to develop a patient's sense of mutual recognition through analysis of the dyadic situation. Structurally, many situations encourage one or two aspects but not all three, as well shall see.

Pathology in networks can be defined as either a failure of a unit adequately to identify its core self (in organizations this may be said to be confusion over the organization's mission); a failure of ego to understand what the other desires from ego and how this does or does not mesh with what ego desires for itself (in

organizations this may be called a lack of synchronized goals); and a failure to understand what the other wants or needs (commonly called a lack of "customer orientation" in management studies). Thus without fear of reductionism, one can extend the issue of "mutual recognition" to organizations and other larger social units. Common problems that occur when one organization relates to another include the organization's lack of a clear definition of what it is, including a mechanism for insuring that this organizational introspection and self-definition occurs regularly. Recognizing that the other organization has its own self-definition and own agenda is also critical as well as recognizing how the other organization perceives the focal organization. Pathologies in this respect are not confined to interpersonal interactions. Brokers who operate in gaining advantages from "structural holes" need to be aware of the others as agents with their own subjectivities or they will fail as brokers.

"Mutual recognition" is a complex phenomenon. Something much more simple occurs in almost all interaction situations and has long been identified by sociologists and social psychologists. This is called by Aron (Aron 1996)"mutual regulation" and consists of "reciprocal influence." This can occur by means of positive and negative sanctions even when there is not full "mutual recognition."

Both mutual regulation and mutual recognition create a unique system in an interaction, a system that brings a third element or factor, into the dyad. Using psychoanalysis cases as inductive material, Ogden (Ogden 1994) conceptualizes his findings as "the analytic third." The dyad creates a system that is a synthesis of ideas, feelings, cognitions, and inchoate unrecognized and unconscious material that influences the course of the interaction. From a sociological point of view, cultural and professional norms and the indirect influence of parties not directly present in the dyadic interaction also act as a third element. Georg Simmel noted this factor as adding a sociological structure to dyads (Simmel 1950). In his view, the third element alters the character of the dyadic relationship. One possibility "[I]s the intensification of relation by a third element, or by a social framework that transcends both members of the dyad. The other is any disturbance and distraction of pure and immediate reciprocity." The third factor is not a symmetric averaging of what each party brings to the interaction, however. Ogden recognizes that there are inequalities of power and information that may be present in the interaction, even though both parties necessarily intersubjectively and very subtly impact one another. In his cases he privileges the analyst who has his own technology, theory, and training to fall back upon, as well as the power implicitly granted to him by the patient. The extent of asymmetry in analytic situations is a matter of discussion in modern psychoanalysis. More generally, however, most "real-life" dyads

whether of individuals or organizations are not interactions of equals. The concepts of "mutual regulation" and "mutual recognition" therefore do not imply that "mutual" means equal.

We can now suggest some propositions about mutuality.

Proposition 4a. All dyads have some form of mutual regulation.

This is obvious from the very definition of a dyad.

How this works out and the variations in mutual regulation are the substance of much work in social psychology and in ethnomethodology and will not be considered here since we are more interested in networks beyond the dyad. Mutual recognition is another matter.

Proposition 4b. Taking the role of the other.

Recognizing the other as having separate subjectivity and agency, the third requirement for mutual recognition is most likely to occur when there are or have been opportunities for a Mead-like "taking the role of the other."

Actual participation in being the other – being a consumer of the product if one is a marketer or being an analysand if one is an analyst are examples. Interestingly, only the second is a formally required condition for playing the self role, though business schools talk about the importance of experiencing the customer role but generally do not require it. As for the first two requirements – self-knowledge and the ability to be reflexive about the self as well as knowing the desires of the other, I do not have at present clear hypotheses about the forces that promote these processes that might apply across various system levels from the person to the organization and even to larger entities. In general, empirical work in this area beyond the realm of individual psychology seems largely lacking.

2.5 Balance and Triads

As we noted above, network analysis really begins with triads, for they are the beginnings of a "society" that is independent of the ties between a dyad. It is worth quoting at some length from a classic source.

> In respect to its sociological destiny … the dyadic element is much more frequently confronted with All or Nothing than is the member of the larger group. This peculiar closeness between the two is most clearly revealed if the dyad is contrasted with the triad [in Simmel's German, 'associations of three']. … Where three elements, A, B, C, constitute a group, there is, in addition to the direct relationship between A and B, for instance, their indirect one, which is derived from their common relation to C. … Discords between two parties which they themselves cannot remedy, are accommodated by the third or by absorption in a comprehensive whole. … Yet … no matter how close a triad may be, there is always the occasion on which two of the three members regard the third as an intruder. (Simmel 1950), p 135.

In Simmel's view, the third can be non-partisan and a mediator, but can also be "*the Tertius Gaudens*" (the third who enjoys) (Simmel 1950), p 154. The third can gain by lining up with one of the two others and thereby gaining his or her own advantage, or can act as a broker between them thereby making a broker's profit. This latter possibility will be taken up at greater length when we consider Burt's "structural hole" argument (Burt 1992). A number of propositions will be developed in that connection.

The addition of a third member to a dyad thus, perhaps surprisingly, vastly increases the complexity of relationships. One important set of ideas hinges on the balance between the three members of a triad and leads to the classic fundamental Balance Hypothesis.

Proposition 5. The Balance Hypothesis

"In the case of three entities, a balanced state exists if all three relations are positive in all respects, or if two are negative and one is positive." (Heider 1946)

For example, the network given above to illustrate a triad shows all three relationships to be positive. But if A dislikes C and B also dislikes C then A and B like one another. Heider further contends that there is a tendency towards balance; "If a not balanced state exists, then forces towards this state will arise." And

further, "If a change is not possible, the state of imbalance will produce tension." Testing this general proposition in detail moves us beyond the realm of elementary network concepts. At this point, suffice it to say that there are 16 possible configurations of triads, and that there are ways of conducting a census of all these possibilities in any network. That census can then be compared with the chance distributions of these triads in the network. In general, the balance hypothesis tends to be supported (Wasserman and Faust 1997), p596.

II. Further Elementary Social Attributes of Nodes and Networks

1. Relationships

We have started to offer concepts that are useful in describing networks. We have mentioned whether relationships between nodes are non-directional or directional, and if directional, whether they are reciprocated or not and the degree of their mutuality. We have also said that there can be more than one relationship between nodes, that is whether relationships are multiplex or not. [Multiplex relationships are discussed in greater detail below, Section II 4]. Finally, we said that the relationship could be one of sharing an attribute or one in which there is a flow between nodes. These attributes can be used to describe relationships between nodes at all levels of social analysis. We tend automatically to think of relationships as being between people -- they like or dislike one another, for example. But we can also describe relationships between organizations. They can share an attribute -- both are organizations involved in dealing with illegal drug problems, for example. In this respect the police and psychiatric clinics can be said to be in the same network. Then we can ask what if at all is the nature of flows between them. Do the police send people to psychiatric clinics; do the clinics send people to the police? If both are true how does this reciprocal relationship work out in practice? Is there more than one relationship between the police and psychiatric clinics? For example do they "exchange" clients (a flow) and are they both members of the mayor's task force on fighting drug addiction (a shared attribute) and if so, how does this multiplex relationship affect them. Answers to these apparently very simple questions can result in complex analyses of the role of different organizations in dealing with drug problems. Just as a reminder, there are also relations between units larger than organizations. There is an entire branch of economics that deals with trade relations between nations (Krugman and Obstfeld 2000).

There are a large range of propositions and studies about pairs of relations, most of which assert that the greater the similarity of the attributes of the pairs, the greater the likelihood of there being a flow between them (see homophily, above). While this may be obvious, consider that most "coalition building" consists of creating mutual flows between pairs that do not share many attributes. There is a major movement in public health and in drug and alcohol that attempts to build community coalitions in an effort to have an impact on drug and alcohol consumption. The proponents remain optimistic. Foundations and the Federal Government continue to fund these programs, yet careful studies show that "overall the documented research evidence for positive coalition or partnership outcomes is weak, or, in stronger language, conspicuous by its rarity" (Berkowitz 2001)(p. 220). This finding is "obvious" to network analysts, because bringing pairs together in the long term when they have quite different characteristics is known to be difficult and rare, but this elementary fact of pair relationships is apparently poorly understood.

Thus far we have mainly been talking about relationships between pairs. If the network consists of several or more nodes, then position of a node in the network becomes extremely important.

2. Position

Much of network analysis is devoting to describing what the entire picture looks like: as in a road map, how easy is it to get from once place to another and how getting places depends on where you are situated. Geographers speak of central location and density of population. As realtors are prone to say, "location is everything." In keeping with network's multi-level micro-macro approach there are many propositions about location that have been applied to small groups. The following general proposition is an example of early work in the field that has been very influential.

Proposition 6 Centrality

> "[W]here centrality and hence, independence are evenly distributed, there will be no leader, many errors, high activity, slow organization, and high satisfaction" (Leavitt 1951)

The concept of centrality has been extremely important in network studies and has been applied extensively, though there are a number of different ways of measuring it (Freeman, Roeder, and Mullholland 1979;

Freeman 1979). The effects of positions of centrality have been studied in organizations and organizational position within industry, and industry position within economies, and so on. A recent application has been concerned with the epidemiology of AIDS and has resulted in a new measure of centrality (Poulin, Boily, and Mâsse 2000). Although geographers are interested in hierarchy, this type of positional arrangement may be of even greater interest to sociologists; formal network studies of the causes and consequences of hierarchy in situations ranging from small groups to nations abound. All in all, there may be more propositions in applied network studies relating to position than for any other topic.[5]

Interest in network position is analogous to the concerns of classical sociology with issues of class, status, and power, to borrow from Weber's formulation. Hierarchy in networks is stated strictly in terms of location of a given node relative to other nodes, without assuming any content to this position. The content is given by the nature of the flow or the connection (i.e. friendship, export of capital, selection by customers, and so on). Without getting into technical formulations it is fairly obvious that a node can be connected to more nodes than others. Since networks can be directional, a node can be connected to many others by virtue of its own actions or preferences (a biotechnical firm sends observers to many universities), or in the parlance of the early sociometry be more "popular" because it is chosen more often by other students. The more general term used today is "degree" -- the number of other nodes with which a given node is directly connected. The number of nodes flowing into a given node is called "in-degree" ["popularity'], and the number flowing from a given node is similarly called "out-degree."

A node can be a strategic broker in the sense that connections between others nodes flow through a given node. An indicator of "eliteness" is the situation in which node is be more often chosen by others who are more often chosen by others in a pyramid of choices.

3. Position and Relationships

All positions in networks are defined by their relationships with other positions or nodes. In interpersonal environments, there are basically two kinds of relationships—those that are ordained by the social system with very specific names, typically, kinship names such as mother, father, children, aunts and uncles and

[5] In February, 2002, Google showed 24,700 "hits" for network centrality.

cousins, and those that are more loosely and generically named friend, neighbor, acquaintance or co-worker. The network properties of each named relationship as opposed to generic relationships are quite different and have been studied in very different ways. But both types lead to puzzles and surprises.

3. 1 Named Positions and Relationships

As we know, networks always involve at minimum two nodes or positions and a relationship between them. Although this may be confusing, the concept of "role" is often used both for the position as well as for the relationship between positions.[6] Named roles, especially kinship relationships such as "father," generally specify not only the meaning of the position but also the content of the relationship of "father" — the mutual obligations and expected behaviors— to other named positions such as "son." Not only do name roles indicate the expected relations with other roles, but also the patterning of other relationships—the expected network past the first order zone. "Primary roles can be cumulated into chains defining compound roles; for example, the sister of my father's father and the subordinate of my boss' protégée." (White 1963), p1. The logical complications of kin relationships can be quite complex and formal network mathematics can help to specify the implications of such matters as bilateral cross-cousin marriages in which "one's wife is also both Mother's Brother's and Father's Sister's Daughter." P. 17 (White 1963). Anthropologists have tended to gather networks of named relationships in almost all of their fieldwork, in part because one can do so with only a limited knowledge of the local language. It is one matter to gather the data about the relationships, and another to understand their implications, as controversies in the literature about the causes and consequences of cross cousin marriage suggest. (Homans and Schneider 1955; Needham 1962; Lévi-Strauss 1969). Named relations are of course far from being the whole story. As White (White 1963) points out,

> "Even where the tribe has an explicit 'official' kinship system, however, it does not follow that one knows the norms applied to actual behavior of individuals, much less the extent to

[6] Merton distinguishes between a named position, which he calls "status" and relationships between statuses. A status may have "role relationships" between it and the other statuses with which it relates by virtue of structure and norms. A teacher (a named status) has a role relationship to students, other teachers, parents, principles, etc. All the role relationships that a status enters into as a part of the definition of the particular status is called a "role set." An individual may have a number of different statuses – for example besides "teacher," the person may also be "father." The set of all statuses that an individual inhabits is called a "status set." (Merton 1968). I find this terminology less confusing and more precise than one that uses "role" for both position and relationships between positions. For propositions using this framework that have much in common with network concepts, see (Coser 1975). The network field however seems to use "role" for both position and relationship and I will conform to this usage.

> which behavior conforms to the norms... A mass of data—on perceived norms, local horde membership, descent groups, kinship terms used for one another by at least a large fraction of tribe members, the composition of explicit kin divisions like moieties and sections, together with extensive records of marriages containing all such information both spouses—is necessary to establish reliably any system or fragments of systems to which various aspects of kinship behavior in a tribe may conform in fact or in principle. Nothing like this quantity of data is presented in existing accounts of a tribe's kinship behavior...Anthropologists in general have not been intent on gathering the volume of systematic data required for full analyses of kinship systems of individual tribes." (P. 146)

That is, anthropologists have gathered massive data about the official names of the positions, but not necessarily systematic data about the relationships between the positions.

3.2 Informal Relationships and informal positions

We will not enter into the details of kinship analysis and the predictions that can be developed from using network analysis to axiomatize kinship structure. But the principle that kinship illustrates is the nature of the association, or lack of it, between formal named and instituted relationships and those that are "informal" or unanticipated. In *Crime and Custom in Savage Society*, Malinowski (Malinowski 1959) (pp 70-84) gives a poignant example of the problems of a young man who wanted to marry a woman who was, from the kinship rules, forbidden to him. Only when anthropologists stay around a long time (Trapped by World War I, Malinowski spent the entire war in the Trobriand Islands though he originally intended to be there for only a year) are they able to do what White advocates—compare the rules to the way they are actually carried out. "… I found the breach of exogamy—as regards intercourse not marriage—is by no means a rare occurrence, and public opinion is lenient, though decidedly hypocritical."(p. 80) (Malinowski 1959). While Malinowski observed many examples of the breach of exogamy and "Most of my informants would not only admit but actually did boast about having committed this offence or that of adultery…" this was true only of intercourse not marriage. He was aware of "only two or three cases of marriage within the clan." But nonetheless these violations did exist.

More generally, almost all network analysis involves at some point comparing the network mandated by culture and the social system to networks created and negotiated by people in the process of trying to manage

and work the "system." The so-called "formal system" is contrasted and compared with the "informal" system. There are those social scientists who feel this distinction is unwarranted, that everything is negotiated and the relationships and mapping between relationships are entirely created through the process of living. To take this extreme point of view is to deny the weight of tradition and habit, but most of all, to deny that concepts and names have consequences with which people daily struggle.

An elementary proposition about formal and informal roles and relations can now be introduced.

Proposition 7. Informal and named relations

"Informal" or non-prescribed or non-instituted relations tend to be correlated with the formal or prescribed relationships.

Informal relations exist in reference to or even in opposition to the formal relationships. It is as if the non-prescribed paths or relationships or exchanges are "draped" upon a scaffolding of the formal relationships. The instituted or prescribed relations are always in some way, even negatively, "taken into account."

Several examples: Joe is especially fond of and friendly with his uncle. There is a relationship prescribed by the family kinship term "uncle." Joe elaborates this relationship, but the elaboration follows the general format prescribed by the kinship relationship.

In a large manufacturing organization I observed, there were formal hierarchical relationships that defined the positions in the organization – the "organizational chart." When critical decisions were to be made, individuals often "skipped levels" and enlisted support above the level of their immediate superior. True, this is an "informal system" for making decisions. But the person chosen as the one higher in rank than the one supposedly entrusted with the decision was hardly picked at random. The choice could be predicted from the organizational structure – it simply did not follow directly from the "rule book" but it was surely related to it. In American national politics there are prescribed, by law, channels for creating legislation. But certain committee members, certain lobbyists count for more than others and are the ones who critically determine what a particular new law is likely to look like. One needs to study all these systems carefully – the kinship, the organizational, and the national legislature – to uncover the informal connections. Nonetheless, these connections are related to the mandates and functions of the formal institutional structure that the informal

elaborates. This is an obvious point, but one which is often neglected when we become entranced by the continuous reenactment and creation of structures. Sociologists find that economic relationships are embedded in various instituted social relationships. In fact, all enacted relationships or networks are embedded within formal arrangements (Granovetter 1985).

3.1.1 Embeddedness of the Informal within Named Networks

Embeddedness can function as the "cause" of the way networks appear. For example at the organizational level, "… political, legal, cultural, industry, and/or regional environmental conditions impact the likelihood of inter-organizational network formation and the forms of networking" (Oliver and Ebers 1998). But networks are not only "caused" by social conditions. Actors have agency and are constantly elaborating on the hand they have been given. This is the position taken by most of the literature that deals with "informal" relations and is concerned with actors as brokers and the makers of connections (Boissevain 1974). Again, to cite research in the organizational area, "… the institutional economics and strategy approaches, by contrast, focus(es) on how to forge networking relations, and how to organize them, so that actors gain access to, and best utilize, such resources and capabilities which will reduce their dependence or otherwise improve their competitive position (Oliver and Ebers 1998). Note that the "actors" referred to here are collectivities, not individual persons, yet the language applies equally to them as it does to the brokers and politicians in Boissevain's analyses. The assumption that actors have agency, will be further discussed below.

3.1. 2 Observed roles that are not necessarily named by participants

Anthropologists make a distinction between "emic" and "etic" concepts. Emic ideas are those that "insiders" to a culture use and "etic" ideas or concepts are those that observers impute to the culture or find useful in describing it.[7] Unnamed positions or roles are those that observers ascribe to a structure and they may or may not be so described and noted by the "natives." The "wheel" communications structure and the central role in it described above are constructs imposed by the researchers in the experiment. In the wheel configuration, most experimental subjects when asked about "the organization of your group" were able to describe it; subjects in other configurations were not able to do so (Leavitt 1951). There is an important literature in the

[7] As with the status/role distinction, the emic/etic conceptualization is also subject to various usages. See (Headland, Pike, and Harris 90) for an extended discussion.

network field that refers to "roles" as discovered through network analysis but not necessarily defined as normative named roles by the participants in the network (White, Boorman, and Breiger 1976). Indeed this literature fails to make the distinction noted here. Positions that have "structural similarity" as discovered through network analysis are often described as occupying a role or a status, though this may not be so notice or conceptualized by participants in the structure. Whether or not the roles are emic or etic does however have important consequences.

Proposition 8. Stability of named positions

Roles or statuses or positions that have names are much more likely to have a longer life than roles or positions that have been ascribed to a structure as a result of network analyses.

Recent work suggest that persons in an organization who occupy a position discovered through network analysis that allows them "structural autonomy" – that is, they can act as brokers between persons who otherwise would not be linked, in fact are not very likely to hold that position a year later (Burt Forthcoming). In contrast, a person who holds a named position is more likely to continue in that position.

To summarize. Network relations can be prescribed by values, organization and institutions. Often, when relations are prescribed, they are given a name. Relational names are very important in predicting the forms that networks take. But the prescribed relations are only part of the story, since relationships are further elaborated on the base of the prescribed. [To be sure, under many conditions the elaborations become instituted and so become prescribed and another round of elaboration begins.] Since most people know the prescriptions, one "charm" of network analysis occurs when the additional elaborated relationships are revealed. But these revelations are only part of the story since as we see from even "Elementary Forms of Kinship" even the prescribed are sufficiently complex so that participants in society see only the relationships which immediately surround them in the first order zone and are rarely aware of the implications of second order zones and are unable to visualize much less model the entire system. Networks have been compared with traffic jams – you can see the cars that surround you but it takes a helicopter to get above the mess and see the entire picture.

4. Multiplexity

Thus far only single stranded ties have been formally considered, though we have given some examples of multiple connections. More realistic networks are formed by multiple connections between nodes. Multiplexity is related to the concept of homophily discussed above, for the bundling of particular kinds of ties is hardly at random and follows the laws of homophily of position that we have already discussed. And multiplexity leads us to a more formal discussion of complete networks, a matter that we will take up in the next section. Multiplexity has been used in the network literature in two related senses: one, some times called role multiplexity (Beggs, Haines, and Hurlbert 1996) refers to the possibility that two nodes occupy more than one position that ties them together, typically, the situation described above in which two nodes have an organizational relationship, say "supervisor" and "assistant" (to the supervisor), but are also friends. Classically, this occurs in village societies in which people are simultaneously kin, workers on the same farm, members of the same religious cult, and the host of shifting roles common to village economies in which tasks are largely filled by part-time specialists in which the blacksmith may also be the head of a clan, the god father to a number of persons, and a local intellectual sage. Bossevain offers this proposition: "Because the activity fields in this small community overlap and the same actors play different roles to the same audience, we may also expect high multiplexity (Boissevain 1974), p. 72. In complex non-village societies, roles may become bundled in a somewhat different way. Merton calls attention to "role sets" – the set of relationships that ensue because one occupies a given role (what he calls status) an idea that Rose Coser further elaborates (Merton 1968; Coser 1975). Because one is a school teacher, one also relates to students, parents, a school administrator, the Board of Education, and so on. These form the role set that goes with the status of teacher. This role set can of course be analyzed using the formal tools of network analysis, especially those that work with "ego networks." These are what might be called "contingent networks." They may or may not also be multiplexed networks.

The second sense refers to the possibility that as a result of having a given role relationship, say "co-worker," there are a number of different flows between a pair persons, for example, advice, friendship, and work on common tasks (Lazega and Pattison 1999). This has been called "content multiplexity (Beggs et al. 1996). Further, the same tie, for example advice, can have a number of different kinds ideas flowing through the tie, for example: a solution to a problem, a reformulation of the problem, how to obtain information about solutions to the problem, reaffirmation of an already identified solution, and the credibility of a proposed

solution (Cross, Borgatti, and Parker 2001)Attention here is directed to the different consequences of these multiple flows and how they are concatenated or conflict under different circumstances.

The concept has an important place in sociological theory and has led to a number of propositions – so many that they will not be detailed here but in the chapters that follow. Here we will merely locate the arenas where multiplexity plays out. First, as we have alluded to, other things being equal, multiplexity is an important indicator of the presence of folk or village society forms of organization and even rural-urban difference in modern America (Beggs et al. 1996). Whether intimate ties can be sustained in modern society as a result of the decline of multiplexity typically found in village society is at the heart of network research that inquires into the relational health of people that live in modern urban settings [See for example, (Wellman 1979; Wellman 1988; Wellman and Wortley 1990; Wellman 1999)].

Second, multiplexity has an important role in theorizing about economic forms. Given the multiple bases upon which relationships could be formed within a community, Padgett shows that over two centuries in Florence (1300 to 1500), said to be the birth of financial capitalism, commercial banking firms were formed over time on four quite distinct bases: first on the basis of family and patrilineage, next on the basis of guilds, then on the basis of social class, and in the last period, on the basis of patronage (Padgett and Ansell 1993; Padgett 2001). The extent that access and trust are available to bolster economic relations is a consequence of multiplex relationships of different mixtures. Ethnic enclaves have been shown to be advantageous to certain kinds of ethnic businesses in part because of the multiplexity of relationships (Portes and Sensenbrenner 1993). Trust among the French financial elite was bolstered by multiplex relations of party, neighborhood, and friendship (Kadushin 1995).

Third, a very substantial proportion of the literature on organizations is concerned with the relationship between ties based on formal positions in the organization and those based on informal relationships as we began to discuss above. The consequences of formal and informal modes of relations within organizations hinges on the how these multiplex relations are construed in different settings. Informal relations were first identified as loyalties that impeded production (Homans 1950). Others have found informal relations as aids to getting things done that augment the formal relations (Lazega and Pattison 1999). There can be complex relations between formal and informal relations that encourage mentoring or prevent acquiring the values appropriate to a given organizational role (Podolny and Baron 1997).

Fourth, there is a complex interrelationship between different kinds of ties in the flow of information and innovation in open non-bounded systems (Valente 1995) that will be discussed in a chapter on the flow of innovation(Burt 1987).

While multiplex relations can be described qualitatively and discursively and one can often get an intuitive sense of what is involved in multiple relations, more precise characterizations of the consequences and causes of different mixes of ties has proven to be a difficult task. The possible combinations of ties can be quite daunting, and the factors that lead to one sort of tie may not have the same force on another type of tie. Recently a class of models related to logit regressions has been developed that can analyze some consequences of different ties between the same nodes in a network, but there are as yet relatively few applications (Pattison and Wasserman 1999; Lazega and Pattison 1999). If one wishes to compare total networks composed of the same nodes but different relations, then it is possible to correlate to the two matrixes(Hubert and Schultz 1976; Borgatti and Everett 1999a), but it is not easy to condition this correlation on various attributes that might characterize the total network, a topic to be discussed shortly.

5. The Strength of Weak Ties

"The strength of weak ties," is the title of a 1973 article by Mark Granovetter (Granovetter 1973) that has achieved almost as much fame and certainly more citations than the famous "small world" described by Stanley Milgram in his *Psychology Today* article (Milgram 1967).[8] Weak ties as a concept describes the nature of a relationship between nodes in terms of the consequences for an entire network. Hence "weak ties" serves as a bridge between concepts that describe relationships and those that describe entire networks. Perhaps the most authoritative statement of the idea is Granovetter's 1982 reprise.

> …[O]ur acquaintances ("weak ties") are less likely to be socially involved with one another than are our close friends ("strong ties"). Thus the set of people make up on any individual and his or her acquaintances will constitute a low-density network (one in which many of the

[8] There were 75 articles searchable by the term "weak ties" in social science citation index, but the term "small world" had 107 articles from a wider range of journals. Granovetter's article is a "citation classic with 1266 citations as compared with Milgram's 139 citations.

> possible ties are absent), whereas the set consisting of the same individual and his or her *close* friends will be densely knit (many of the possible lines present).
> … Ego will have a collection of close friends, most of whom are in touch with one another – a dense "clump" of social structure. Ego will [also] have a collection of acquaintances, few of whom know one another. Each of these acquaintances, however, is likely to have close friends in his or her own right and therefore to be enmeshed in a closely knit clump of social structure, but one different from Ego's… These clumps would not … be connected with one another at all were it not for the existence of weak ties (Granovetter 1982), p.105-106 [italics in original].

The "strength" part of the argument is contained in the following two propositions:

Proposition 9: Weak ties facilitate the flow of information from otherwise distant parts of a network.

> [I]ndividuals with few weak ties will be deprived of information from distant parts of the social system and will be confined to the provincial news and views of their close friends.
> …

Proposition 9a: Weak ties help to integrate social systems.

> The macroscopic side of this communication argument is that social systems lacking in weak ties will be fragmented and incoherent. New ideas will spread slowly, scientific endeavors will be handicapped, and subgroups that are separated by race, ethnicity, geography or other characteristics will have difficulty reaching a *modus vivendi* (Granovetter 1982), p. 106.

There is much evidence for these assertions, and some of the applications of this evocative idea will be taken up in future chapters, but there are also problems. First, the definition of what constitutes a weak tie or relationship can be somewhat slippery. Is it the length of time one knows someone else, the frequency of interaction, the subjective "closeness" one feels, whether the alters are defined as relatives, friends, or acquaintances, or any number of a variety of possible indicators including multiplexity. Second, it is important to understand that the critical idea is one of bridges between network segments. As Granovetter puts it, "The

importance of weak ties is asserted to be that they are disproportionately likely to be bridges as compared to strong ties, which should be underrepresented in that role. This does not preclude the possibility that most weak ties have no such function" (Granovetter 1982), p. 130. Third, it must be the case that "(1) something flows through these bridges – they actually serve as conduits bearing information and influence to groups they otherwise would not get, and (2) whatever it is that flows actually plays some important role in the social life of individuals, groups, and societies" (Granovetter 1982), p. 130. A flow can occur only under some circumstances. Passing along information or exercising influence should not be too costly to the weak tie that constitutes the bridge, otherwise, strong ties that are willing to bear the cost will be more effective in making the bridge. For example, if a mere acquaintance knows about a job (the original context of Granovetter's study), if the acquaintance does not need the job himself or herself, then there is little cost in passing along the information. It would take a strong tie to pass along information that might cause a loss to the person passing it along.

III. Aspects of Complete Networks

1. Position and Social Capital

In the social stratification literature the concept "human capital" refers to the resources that individuals bring to the table such as their education and experience. Organizations of course have capital in terms of the usual definition, financial resources, but also in terms of qualities less easily measured such as the good will of various stakeholders. Nations too have various forms of resources. [See Porter (Porter 1990)] All these are attributes more or less contained within the "box" of the nodes or object itself. In contrast, the "social capital" of a node refers to the network position of the object or node and consists of the ability to draw on the resources contained by members of the network (Lin 1999)[9]. A node's "popularity," a broker position or a network elite position affects this ability. Much of this ability then depends on the extent and shape of one's networks, the resources available to members of the network, but also on the node's ability to know how to make connections, as noted above in the brief review of the "small world problem." "The Strength of Weak Ties," (Granovetter 1973; Granovetter 1982) argument just reviewed, shows how relations with individuals

[9] There is another use of "Social Capital" that refers to the resources of an entire network (Coleman 1988), an interesting topic in itself but not the subject of the current discussion.

only weakly linked to a focal person put that person in touch with others who are not members of one's immediate circle. The consequence is that one gets information about jobs that are not known to one's own circle. In another early and influential work on networks, Boissevain (Boissevain 1974) gives various examples of people who use network brokers to connect them with resources not directly available to them. One of the major arguments put forth by (Wilson 1997) is that the urban poor in isolated Black ghettoes lack connections with sources of work. Burt (Burt 2000) shows that network positions in which the focal node is connected with other nodes themselves are not connected with one another ("structural holes") is an important form of social capital. This argument applies to individuals, firms, and entire economic sectors. Social capital, then, is not directly an attribute of individuals, but rather their ability to draw upon their position in a network. There are a great many propositions related to these kinds of chains and social capital that we will later explore. (See (Kadushin 2004))

2. Thresholds

Another form of the effect of networks as a totality on individual nodes is contained in the concept of "threshold" or what is sometimes called "tipping point" (Granovetter and Soong 1983; Valente 1995; Valente 1996; Gladwell 2000). This idea refers to the extent to which a given phenomenon is spread throughout a network. Once a certain level has been reached, then all the nodes join in the behavior or phenomenon. In this model, the probability of any individual node acting is a function of the number of other nodes in the network that have acted in a given way or possess the given quality. It is a step function, rather than a linear one. Thus, the action is not necessarily dependent upon one's immediate partner(s), but on the relative number of nodes throughout the network that have adopted the given behavior or attribute. Not only is this a key idea in "crowd behavior" where the adoption of the behavior is visible to all, but in other kinds of diffusion models. Following our insistence that network models apply to macro as well as micro phenomena, the adoption of behaviors by other organizations as an influence on the focal organization is a key component to the theory of the "new institutionalism." Grounded formal propositions about what proportion of others is necessary to effect adoption, what the effect is of network visibility, the extent to which the others are "weak ties," and to what extent the adoption functions follow a strict step function are unfortunately in their infancy.

3. Network Segmentation

We have looked at networks as they radiate out from individuals and briefly examined total networks and positions within these networks. One of the major preoccupation of social analysts, however, is elaborating on the observation that people, organizations, institutions, countries -- any social unit one can imagine -- are not uniformly related to one another but tend to come clustered into groups or sets. So one of the major tasks of network theory and analysis is to develop ways of describing and analyzing these clusters or groups.

3.1 Named and Unnamed Network Segments

As with network position, there are emic and etic clusters or groups. It will be recalled that emic positions are those that are named by participants in the culture and social system – teacher, president, and father are examples, whereas etic positions are those that are found by network analysts and observers such as "high centrality." Emic groups are named and recognized by the "natives." These can range from a club or gang with a name such as "Hell's Angels," to a corporation such as "General Electric," to a legal government entity such as "New York State." A group or cluster has "members." That is, there are individuals who are members of Hell's Angels, there are both individuals who are members of General Electric but also other organizations or groups can be members of "GE" such as "GE Capital." In general, with respect to named groups, members (1) themselves know that they are members of the group and (2) others know that they are members of the group and can identify them as such. There is a third attribute to membership in an emic group that is generally but not always true: members interact with one another more than they interact with non-members. In contrast with emic groups, there etic segments of a network – segments that are identified by observers. Examples are the "C's": clusters, cliques, clacks, circles, cabals, (but not clubs – they are emic), coalitions, and also some non "C's" such "group" and "block" that are usually etic entities identified by observers and not necessarily noticed by natives. Generally, the boundaries of these structures are not firmly established and are the product of the observer's analysis. Even cliques, though noted in popular language are often fluid entities whose membership may be a matter of disagreement. The interplay between the formally named entities and the observed unnamed clusters is the subject of much network analysis and indeed is the source of employment for a number of organization consultants who show how informal groups within formal organizations either grease the wheels of the organization, act as impediments to the organization achieving its goals, or both. We will have much more on this topic in the chapters that follow. In the

meantime, a brief discussion of "primary group" and cliques follows as an introduction to the problem of network segmentation and partitioning.

3.1.1 Primary Groups and Cliques

Primary group, a venerable sociological term, was introduced by Charles Cooley in 1909.

> By primary groups I mean those characterized by intimate face-to-face association and cooperation. They are primary in several senses, but chiefly in that they are fundamental in forming the social nature and ideals of the individual. The result of intimate association, psychologically, is a certain fusion of individualities in a common whole, so that one's very self, for many purposes at least, is the common life and purpose of the group. Perhaps the simplest way of describing this wholeness is by saying that it is a "we"; it involves the sort of sympathy and mutual identification for which "we" is the natural expression. One lives in the feeling of the whole and finds the chief aims of his will in that feeling. (Cooley 1909) p 23.

Cooley notes that members of a primary group identify themselves with it. Nonetheless, the concept is a construct of the observer and not of people themselves.

One of the first applications of network analysis was in the early 30's when "sociometry" showed how artificially to construct primary groups of adolescent delinquent girls who were incarcerated in an institution that housed them in separate cottages. The aim was to place girls who liked one another into the same cottage rather than having cottages populated by warring cliques (Moreno 1953). When grouped into cottages with greater group cohesion, the girls were less likely to be cantankerous. Moreno successfully constructed primary groups or natural cliques or what were described above as "strong ties" that substituted for the lack of functioning families in this situation. The exercise of finding dense regions of networks such that the connections within the regions are more dense and more cohesive than the connections outside the region has occupied network analysts ever since.

3.1.2 Principles of Network Segmentation

3.1.2.1 Density

The problem of defining and then finding cohesive groups is more complex than it might seem given that the simple aim is to find regions of a network that are more dense or, in sociological terms, more cohesive than the network as a whole.[10] There are several considerations. First, there is the matter of density of connections within a group. This might be defined as the number of connections, direct or indirect within a group. A direct connection or path is one that connects *A* directly to *B*, while an indirect one is a path that connects *A* to *B* via *C*. (above p. x). The connections might be mutual and reciprocal, in which case we would be more likely to assert that those so connected are a group, or some connections might be unreciprocated. We could also take into account multiplicity of ties (see above p. x); that is, to give an example from the realm of individual people, A and B are connected because they belong to the same social club but they also do business with one another. Finally in terms of paths between nodes, we might be concerned about the number of different ways one could get from A to B indirectly. Say if a rumor was spread, if one heard the same rumor from a number if different sources it might be more believable, and this believability might be an aspect of group density. All of this refers to relations *within* a group. But most observers would prefer that a group be an entity in which all these connections within the group are greater than those between members of the group and others who are not members. It is difficult in a practical way to satisfy both conditions simultaneously, namely that connections be greater within the group than with nodes outside the group, though some algorithms allow for this (Frank and Yasumoto 1998).

Recently White and Harary (White and Harary 2001)have returned to the concept of group cohesion and reintroduced the idea that a group is cohesive to the extent that the members are pulled together when confronted with disruptive forces. Cohesiveness can be gauged by seeing what happens to the disconnectedness of group when one or more members (nodes) are removed or, keeping the same number of nodes, when one or more paths or connections between the members or nodes are removed. The former is called cohesion and the latter adhesion. They then show that these two measures are equivalent. In this approach it is possible to have a group that is relatively resistant to disruption yet has lower density of relations between its members than some other equally dense group that is less cohesive in these terms.

[10] There are several useful summary references to the literature on finding cohesive subgroups within networks. See (Wasserman and Faust 1997), Chapters 7 and 8; (Freeman 1992), (Frank 1995), and most recently, (White and Harary 2001).

Especially interesting is the possibility that there are groups with sparse connectedness that can actually be quite cohesive in the sense proposed.

3.1.2.2 Structural Similarity

There is another principle of segmenting networks that has had wide application. Rather than find the connections among members of a cluster, as the methods above do, these methods examine the pattern of relations with others. Nodes that have similar patterns of relationships with other nodes are then grouped together. The method is called structural similarity (Burt 1992) (Borgatti and Everett 1992)(see above with respect to network positions) and a method that looks at various patterns of similarity achieved in this way is called "blockmodeling" (White et al. 1976)

3.1.3 Types of network clusters

There are several types of non-named network clusters that emerge from these various approaches to network segmentation. First, there are clusters that have some of the structured characteristics of named groups and organizations in that there is a relatively clear hierarchy of positions within the group or cluster. Further, the clusters do not overlap. That is, a node cannot simultaneously be a member of two clusters. In terms of "primary group" relationships, the relations between members of the group are based on regular interaction and the amount of their positive sentiment towards one another and persons can be ranked in term of their centrality to the group. Those with more positive feelings towards one another are at the core, those with less are more peripheral, and in general this constitutes a hierarchy though some exceptions in strict rank ordering are permitted, as befits the way most groups operate. In other words, in general if *A* is of higher rank that *B* and *B* of higher rank than *C* in terms of the sentiment of members towards one another, then *A* is higher than *C*. This is called triad transitivity. The groups are also defined as non-overlapping. Freeman asserts that these groups or clusters come closest to the basic characteristics of primary groups as defined by the literature (Freeman 1992). As common with almost all networks, however, this restriction to groups composed of interacting individual persons can be relaxed so that the nodes may represent organizations, countries, or other collectivities.

The clusters above are described in terms of nodes' relationships with one another. As we said, however with respect to positions, we can define nodes in terms of their relations with other nodes. A node "1" may be in the same cluster as node "2" if the two of them relate to a set of other nodes, "3" through "N" in a similar fashion. Clusters are formed on the basis of "structurally equivalent" others. These clusters also may have a hierarchical pattern. One such type of structural equivalent cluster is called a "blockmodel" (White et al. 1976). The blocks cluster nodes that have similar patterns of relating to other nodes. The modeling aspect comes from the fact that blocks so constructed are abstractions from the data that have the advantage of being algebraically manipulable. [For present purposed we are interested in some of the types of blocks or clusters that have been proposed, rather than how they can be further transformed.] Let us represent the clusters or blocks by a matrix of 1's and 0's. In the following example, there are two blocks, A and B each consisting of a number of nodes. The 1's represent the presence of a relationship; the 0's the absence of a relationship. The tables are read in terms of the rows relating to the columns. In the first row, block A relates to block A and to block B. In the second row, B relates to A but not to itself. Remember, these are not nodes, but *clusters* of nodes.

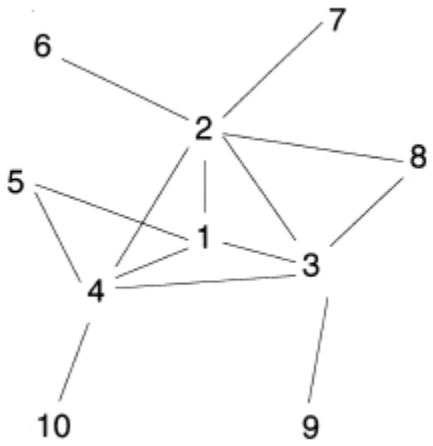
Core/Periphery

	A	B
A	1	1
B	1	0

This is called a core/periphery model and as will be seen, has wide applications in social science.

3.3.4 Core Periphery Clusters

Consider the following example of a symmetrical network taken from (Borgatti and Everett 1999b).
Figure 2



The adjacency matrix Figure 3 below (an adjacency matrix that shows which node relates to which other nodes, hence "adjacency') from (Borgatti and Everett 1999b) is exactly equivalent to Figure 2 above. The adjacency matrix has a "1" if the intersection of the row and the column have a relationship; "0" if they do not. In the matrix below, 1 is related to nodes 2 through 5, but not to nodes 6 through 10. This matrix as befits the figure above is symmetric. One could get the same information from either the upper or lower half of the matrix, when it is split along the main diagonal. In this matrix, nodes are not related to themselves, so the diagonal is blank. It is possible, however, to define a relationship with oneself, though at present we are not considering this possibility.

Figure 3

	1	2	3	4	5	6	7	8	9	10
1		1	1	1	1	0	0	0	0	0
2	1		1	1	0	1	1	1	0	0
3	1	1		1	0	0	0	1	1	0
4	1	1	1		1	0	0	0	0	1
5	1	0	0	1		0	0	0	0	0
6	0	1	0	0	0		0	0	0	0
7	0	1	0	0	0	0		0	0	0
8	0	1	1	0	0	0	0		0	0
9	0	0	1	0	0	0	0	0		0
10	0	0	0	1	0	0	0	0	0	

In terms of blockmodels, nodes 1,2,3,4 can be abstracted as "Block A," and nodes 5,6,7,8,9,10 abstracted as "Block B." The blocks' abstract relationship to one another is depicted as the core/periphery model encountered above.

	Core/Periphery	
	A	B
A	1	1
B	1	0

Not every B is related to every A, though none of the "B"'s are related to one another (There is no statistical theory here, but the trend is obvious). This particular core/elite model assumes that the core and the periphery have some mutual relationship, but generally on terms dictated by the core. The core obviously has the most to offer, since we see that the periphery does not relate to itself. Along with studies of national and community elites (Laumann and Pappi 1976; Lauman and Knoke 1987; Higley, Hoffmann-Lange, Kadushin, and Moore 1991), there are studies of interlocking directorates that show a core (Mintz and Schwartz 1985), studies of world systems that utilize a network approach to show an economic core (Snyder and Kick 1979), organization studies that show a core leadership (Faulkner 1980) and the concept of core/periphery has an important place in studies of rates of currency exchange between countries, as well as studies of migration, and the diffusion of ideas and knowledge. There are about 70,000 "hits" on these words in Google as of

March 2002. While the general idea is clear, Borgatii and Everett note: "Given its wide currency, it comes as a bit of a surprise that the notion of a core/periphery structure has never been formally defined. The lack of definition means that different authors can use the term in wildly different ways, making it difficult to compare otherwise comparable studies" (Borgatti and Everett 1999b), p. 375.

There are several other kinds of elite cores.[11] There is a "caucus" type of core. Breiger suggests that this type of cluster can be applied to the community power literature (Breiger 1979). Those active in block A "run" the community and do not pay much attention to the others who simply do not have political relationships (though they might have others). The core simply does not take account of the periphery. The block model below depicts a caucus.

Caucus

	A	B
A	1	0
B	0	0

If we consider directed graphs, those that are not necessarily symmetrical, then we can have the Groucho Marx situation as in his famous line, "I sent the club a wire stating, 'Please accept my resignation. I don't want to belong to any club that will accept me as a member.'" A relates to A, B relates to A, but A does not relate to B nor does B relate to itself.

Groucho Marx Core

	A	B
A	1	0
B	1	0

[11] We are using the abstractions of block models to depict types of non-overlapping networks segments, regardless of the actual algorithms or techniques that were used to discover them. It is easiest to discuss the core/periphery model in terms of absolutes or abstractions; in actual practice, being in the core or the periphery can be a matter of degree.

More generally, this is a diffusion model from a core: the core has what other nodes want, so they look to it. Unlike a trading situation, the core does not want anything from the periphery.

There can be a situation in which A remain the elite in that they relate only to themselves, but B also has some density of relating to other B's, and also relate to A. Breiger calls this situation one of "deference." A wants nothing from B, but the B's have something to offer to one another.

	Deference	
	A	B
A	1	0
B	1	1

To complete the logic of core/periphery, there can be the following kind of relationships in which the last come first and "the meek inherit the earth."

	The Meek	
	A	B
A	0	0
B	0	1

This simply turns the caucus or the elite core blockmodel on its head, assuming that the B block has less of the power attributes. We suspect that this model is empirically not present on this earth.

The "meek" blockmodel, however, suggests a proposition about core/periphery networks.

Proposition 10. Cores possess whatever attributes are most valued by the network.

While this seems like a simple tautology it is not and may be the result of extremely complex processes. The network is about relationships and flows, not about the attributes of the nodes. This proposition says that in

core/periphery structures the valuation of the attributes is related to the structure,[12] though the proposition does not state which comes first: do the nodes that have the most of what is valued come to be the core, or do the nodes that already have the most of what is valued impose their values on others who have less and confine them to the periphery. This proposition was first formally noted in terms of leadership and norms by George Homans in his reinterpretation of the "Norton Street Gang" in *The Human Group* (Homans 1950). Leaders were said to embody more of the norms of the group than followers. Similarly, the core in world/systems theory has the more advanced economy, political core elites have more power, the core in overlapping corporate boards of governors have more control, and the core in cultural diffusion has cultural hegemony. This proposition will be elaborated upon in the chapters that follow.

Thus far it seems that network analysis is a scheme that merely enforces the status quo. That is, the network embodies the values of the system, and the core/periphery model allows for no change. Yet there is one logical possibility that has not yet been examined. In terms of the network relations of being active in politics with others, there could be a situation of two clusters or caucuses that polarize the community. They relate to themselves but not to one another.

	Polarization	
	A	B
A	1	0
B	0	1

This polarizing situation is obviously an unstable situation that could lead to change. Coleman describes this kind of structure as the second stage in community conflict after an issue is introduced (Coleman 1957). This blockmodel implies the following proposition:

Proposition 11: Network polarization is a key process in social change

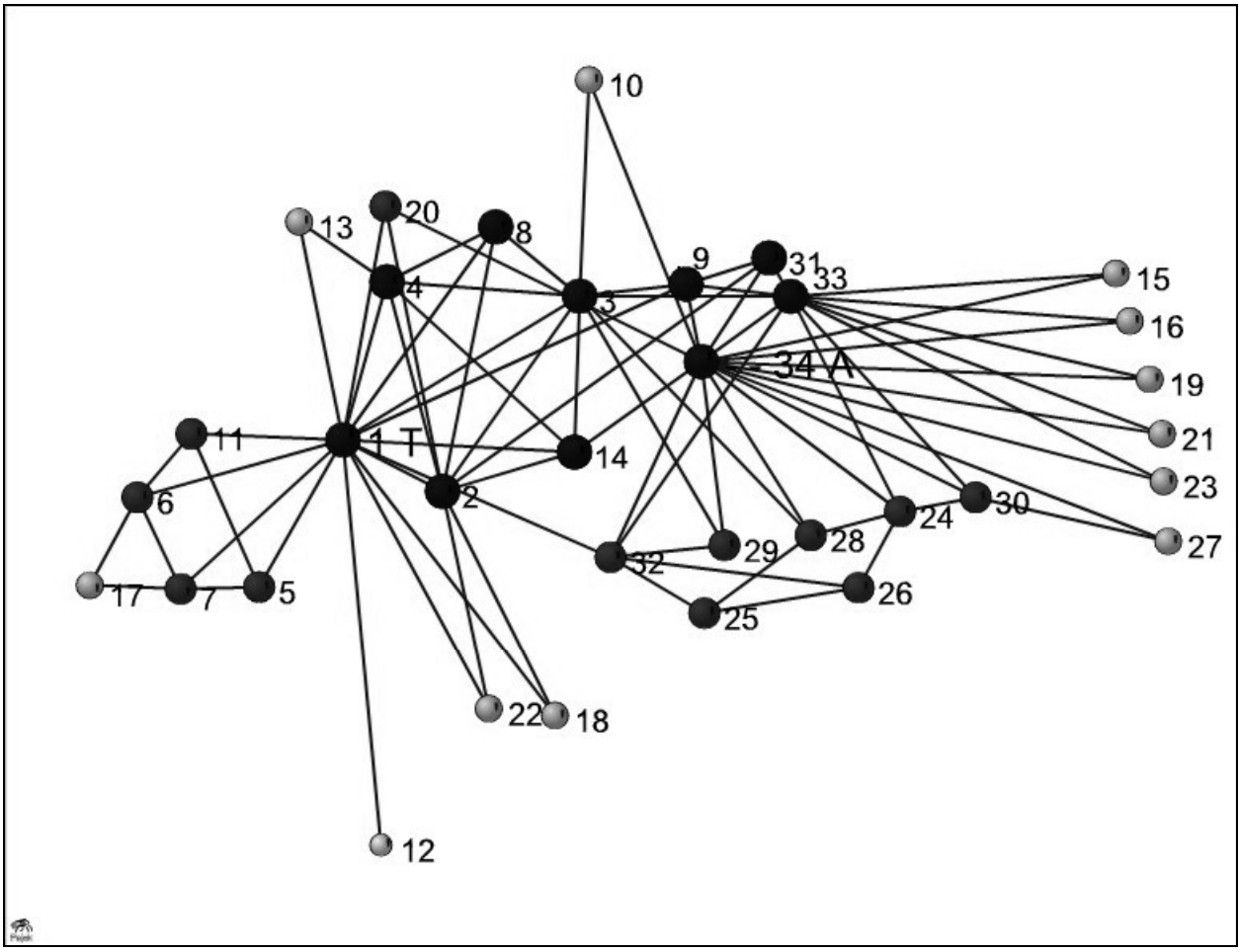
Again, the direction of the causation is not specified. Either social change leads to polarization of networks in the sense shown here, or polarization of networks leads to social change in terms of norms, values, and other social structures. The ramifications of this model for change will be discussed in the chapters that follow.

[12] For a similar point see " (Borgatti and Everett 1999b), p. 394.

A much-analyzed example from a small group, a karate club observed over two years by an anthropologist, Wayne Zachary, is depicted below in a graph taken from White and Harary (White and Harary 2001) and graphed with the aid of the *Pajek* computer program (Batagelj and Mrvar 2002)[13]. The graph in Figure 4 depicts the network of friendships among the club members. The polarization or factionalism is evident from the graph. Eventually, the club split into two, with those closest to leader T (the karate teacher) following him, and those closest to A (the administrator) following him. Detailed analysis shows that a few members were on the fence and one could not predict which faction they might join. This is not the place to give explicate the various algorithms that might be used but to give the general ideas of change and splitting. It is evident that in a "real" situation such as this one, there is not perfect polarization as required by the ideal blockmodel shown above, but rather that there are overlapping cohesive groups that have some degree of ties to one another but that are nevertheless more aligned with one faction than the other. White and Harary utilize their structural cohesion methods to show that the individuals aligned themselves with the leaders with whom they had the most cohesion. Members 1-8, 11-14, 18,20, and 22 followed T; members 9,15,16,21, and 23-34 followed A; and 17, 10, and 19 belonged to neither faction (White and Harary 2001), Table 6. For the present the main point is that network polarization is a key correlate of social change.

[13] Moreno graphed his "sociograms" by hand. But graphing even small networks by hand is extremely laborious and what is more, easily prone to error. In an early attempt to graph networks by computer, we discovered that all the published graphs we could find for which we also had the original data contained at least one error (Alba and Guttman 1972).

Figure 4: Zachary Karate Club as graphed by White and Harary (White and Harary 2001), their Figure 14.



In the real world, there are rarely two choices and blockmodels can be complicated by adding additional blocks, C, D, …N, into the model. The models above that depict just two blocks are intended to present the basic idea of core/periphery models that may be somewhat effaced by the complexities of multiple blocks.

3.2 The Penumbra, Multiple Flows, and Cross-Cutting Circles

The notion of a degree of "coreness," as it were, and the difficulty in the karate club of drawing a clear partition illustrates some practical difficulties in segmenting networks into regions or groups. These apparent technical difficulties actually stem from important theoretical concerns. Social life is messy, and social networks are therefore far more complicated that the networks of electrical circuits that were the first applications of network theory. First there is the problem of the penumbra -- that is, the extents to which there are clear boundaries within society. With instituted groups or organizations the boundaries are apparently clear. We think we know who is a member of classroom x or organization y or even kinship moiety z. But if social life is conceived to be a skein or chain of relationships of potentially infinite regress, where do we draw the cut-points? What do we do in our classroom sociometric analysis with a student who shows up only occasionally? The standard bearer of change in modern corporations, US General Electric Company former CEO Jack Welch, declared in a recent Annual Report to the stockholders that corporations were essentially "boundaryless"(General Electric Company 2000), p 2. Customers, suppliers, and owners are all said to be "stakeholders" whose claims must be satisfied and who have recurring relations with the core of the organization that are ignored only at the peril of the organization. Then there is the "business group" and other extensions of corporate boundaries so familiar in Japan and Israel (Maman 1997). There are no neat "true" cut points cast in stone. We make them relatively arbitrarily for a given purpose; designers of computer algorithms that struggle with how to partition networks are well aware of this.

Another practical difficulty with profound theoretical implications is the matter of multiple flows and crosscutting statuses. Any set of nodes in real life has multiple flows with one another, so there is never one network connecting the nodes, but many. This is true at all levels: people, organizations, nations, etc. We would like to construct <u>the</u> network connecting the nodes. Unfortunately, a theoretical calculus for indexing or adding one type of flow to another does not exist (unless they are all reduced to money, in which case social network analysis is severely limited). If this deficit is taken as an advantage, then an important task of network analysis is to develop propositions about the relationship between flows and/or between networks based on different flows. For example, in a study of the French financial elite, I reported that having been to the Grand Ecole ENA in the past was related to who was friends today; moieties (a concept that will be shortly elaborated upon) based on friendship were related to who sat on the same corporate boards (Kadushin 1995). In an interesting extension of this analysis based on additional data on corporate deals,

Frank and Yasumoto (Frank and Yasumoto 1998) show that cohesive subgroups based on friendship are related to abstention from hostile business deals within the groups but to support in business deals with others not in their group. This latter support (mainly in corporate takeover attempts) is interpreted as building up "social capital" based on exchange principles with financial leaders with whom one does not have an "enforceable trust" relationship. That is, these are typical "brokerage" or "Godfather" relationships ("let me make you an offer you can't refuse") characteristic of situations with structural holes. The expectation is that when the debt is called, the other who otherwise would have no motivation to help will come through. The issue of motivation in networks will be discussed in greater detail in the next chapter.

3.3 Social Circles

The phenomena of multiple flows, cross-cutting statuses, and the softness at the edges of network derived clusters combine to produce a reality that makes problems for statistical analysis because most statistics are based on the assumption that units are independent from one another. The social reality, however, is that many network clusters are composed of cross cutting smaller units built up into larger ones which in turn overlap with one another, as we saw with the example of the karate club.[14] This view of society was first enunciated by Simmel (Simmel 1955) who sees society as a complex skein of partly overlapping relatively loose networks that he called "social circles" (Kadushin 1966; Kadushin 1976).

Social circles are characteristic of modern mass society and serve to integrate apparently disconnected primary groups within larger societies. It is worth quoting extensively from Simmel's original formulation:

> The development of the public mind shows itself by the fact that a sufficient number of circles is present which have form and organization. Their number is sufficient in the sense that they give an individual of many gifts the opportunity to pursue each of his interests in association with others. Such multiplicity of circles implies that the ideals of collectivism and individualism are approximated to the same extent. On the one had the individual finds a community for each of his inclinations and strivings which makes it easier to satisfy them. This community provides an organizational form for his activities, and it offers in this way all the advantages of group-membership as well as of organizational experience…

[14] There are several network clustering algorithms based on this form of agglutination. For an early attempt see (Alba and Kadushin 1976)

> … An advanced culture broadens more and more the social circles to which we belong with our whole personality; but at the same time the individual is made to rely on his own resources to a greater extent and he is deprived of many supports and advantages associated with the tightly knit, primary group. Thus the creation of circles and associations in which any number of people can come together on the basis of their interest in a common purpose, compensates for that isolation of the personality which develops out of breaking away from the narrow confines of earlier circumstances. (Simmel 1955), pp.130-135[15]

A circle has neither clear boundaries nor a formal leadership. Rather, it is a more dense region of a network. The nodes could be of any kind, but in Simmel's original idea they were people. The nodes are not necessarily directly linked. More often than not they are connected through third or even fourth parties. Circles typically illustrate the "small world" principle: one goes to a gathering in which one apparently knows not a soul. One asks, "Do you know X?" as a way of locating both oneself and the people in the gathering. One asks this of several people. More often than not, the others know X. This is the sign that one is in the same social circle (that's how one happened to come to the gathering in the first place). If it turns out that after several tries no one at the gathering knows X, it is probably a sign to leave. One is in the "wrong" circle. It is obvious that the concept of social circle is related to the "Small World." Because the world is clustered into overlapping social circles, it becomes both smaller and larger: if one belongs to the same circle, then distances between nodes are smaller, though density remains lower than for true primary groups. If one does not belong to the same circle, then the distance between nodes may be very large and seem to create a situation in which there is almost an infinite number of "degrees" between nodes.

The "flow" through the nodes of the circle is an interest in the same ideas, concerns, values, or in the case of an economic circle, in the exchange of valued commodities. Industries especially based on external economies are said to be embedded (Coser, Kadushin, and Powell 1982), (see above p.x)(Uzzi 1996). These include the arts and communications, but also the New York City high fashion garment industry ("Seventh Avenue"), and finance ("Wall Street"). These are all industries in which it is economically not viable to include within the organization all the factors of production (Williamson 1981). In the case of the high fashion garment industry, for example, runs are short, and must be timely. It is not reasonable to stock all anticipated fabrics, buttons, etc., or to own the sewing and cutting establishments, etc. In publishing, it is possible to open a house with no

[15] Bendix changed Simmel's use of "circle" to "group," which he erroneously thought was more appropriate. I have changed "group" back to Simmel's original usage. In my view, group is either a primary group or a named instituted cluster that is more dense than the more loosely structure social circle.

more than a telephone and a computer. All other production factors from writers to editors to publicists to printers to binders can be put together for each production of a book. But as "Wall Street" even in the modern era of the internet has discovered (there is much research to support this proposition), for some purposes, especially what one might call "faith achieving" [the development of trust -- according to William James as interpreted by Samuel Klausner (Klausner 1964) -- the ability to act in the face of existential anxiety] there is no substitute for face-to-face interaction, at least to establish the basis for future non-face-to-face interaction and to develop or renew trust. Hence in the United States all these industries have place names: "Broadway," "Hollywood," "Madison Avenue," "Seventh Avenue," "Wall Street" and the like. In "The American Intellectual Elite" (Kadushin 1974) I showed that 50% of the intellectual elite lived within about 50 miles of the Empire State Building, a radius I called "lunch distance" which was the distance which allowed a writer to come into the city, have lunch with his editor, and return home easily within the same day. Thus the distance is more dependent on means of transport than the actual distance in miles. We will have a more extensive discussion of the role of geographic distance as compared with network distance and the extent that modern societies still retain some important aspects of "social support," as Simmel and later Barry Wellman suggest(Wellman 1988; Wellman 1999), in the chapter that deals with communities – both geographic and virtual.

As Simmel's early discussion suggests, circles are related to or developed from various instituted forms and do not function completely independently. In the case of the cultural/intellectual circles of Berlin of the 1920's that he had in mind, the pegs were various "interests and common purposes." This may be true of circles of organizations that form external economies, but there are other structural pegs as discussed above.

We can now introduce two key propositions about social circles.

Proposition 12. Members of social circles, especially core members, enjoy some characteristics of primary groups: social support and enforceable trust.

In Simmel's original formulation he noted that social circles can substitute for some of the attributes of primary groups, notably, the kind of social support that they offer. Importantly, social circles not only create the conditions for trust, but for enforceable trust. If trust is violated, there are sanctions that are expected and can be applied. In the French financial elite (Kadushin 1995), in economic systems of new immigrants (Portes and Sensenbrenner 1993), and in Renaissance Italian elites (Padgett and Ansell 1993), to note just a few

disparate examples, nodes that are members of social circles expect that trust be enforceable. This matter will be taken up in detail in chapters that deal with organizations and with political elites.

Proposition 13. The greater the number of intersecting social circles of which a node is a member, the greater that node's social capital.

This proposition follows from the considerations of loose ties, brokerage, and structural holes, above, when network social position was discussed. The concept of social circle amplifies the notion of position and places in the context of the elaboration of urban life initially described by Simmel. For example, in my study of people who began psychotherapy it was shown that cultural circles in New York in the 1960's tended to intersect with circles of people interested in psychotherapy. There is no necessary logic to this intersection but it is a matter of history and social development. But it did mean that the norms and ideas as well as information of one circle were more readily available to the other. One of the practical consequences of this was that working class persons who tended not to belong to New York Cultural circles were less likely to bring "presenting problems" to psychiatric clinics that were attractive to the therapists and that fit in with therapists' ideas as to what sorts of problems were appropriate for psychotherapy (Kadushin 1969)

Further, an important aspect of networks, as we saw above, is "brokerage" and persons who have access to many disparate circles are more likely to be brokers, another form of social capital. Circles have a dual nature. High density is important for easy access to the external economy for the core of the circle, but social circles also need "brokers" who turn a profit, as any observer of the cultural or economic scene knows intuitively. Brokers are absolutely essential for circles to function, since they are NOT composed of tight networks, do not have a formal leadership structure and are largely non-hierarchical, and have much space between the nodes. This accounts for their flexibility, of course, but they cannot function effectively in the creation of culture or goods, or money without brokers. The broker is of course the manipulator of structural holes and the intermediary in "loose ties." Indeed, as cultural industry circles become more global and therefore density becomes much lower, there are two parallel and related trends. Official brokers or agents become even more important, and economic organizations in the cultural realm attempt to incorporate within their organizations diverse media in an attempt to make the "synergies" which circle based external economies now find difficult to provide. This will be discussed at greater length in the chapter on social circles and organizations.

3.3.1 Patterns of social circles

The most often-identified macro pattern of social circles seems to be once more a core periphery pattern with the core now consisting of a set of overlapping social circles. But there is an interesting pattern in which circles in a society seem to be split into moieties. Lévi-Strauss defines the term as follows:

> "… [A] system in which the members of the community, whether it be a tribe or a village, are divided into two parts which maintain complex relationships varying from open hostility to very close intimacy, and with which various forms of rivalry and co-operation are usually associated." (Lévi-Strauss 1969) (p. 69).

In Lévi-Strauss' usage, moiety is an etic named structure, but the concept seems to fit equally circles that are observed by non-members of the system. While there are relations between the moieties, interaction within them is denser than interaction across the moieties. Unlike polarized networks in which the rivalry is unalloyed by cooperative ties, moieties can exist as stable situations as in the French financial elite that was split into socialist and non-socialist moieties but managed together to cooperate so as to maintain a relatively stable financial system(Kadushin 1995)

To summarize: network segmentation is a critical area for network theory and the one in which hypotheses most relevant to the practical concerns of the arts and the economy are most likely to emerge. Traditional network analysis, however, tends to emphasize clearly definable and separable units, which turns out not to be especially apt or useful in either the cultural or the economic realms. Fuzzier sets and units may actually lead to clearer and more accurate thinking. If this is a post-modern view, so be it.

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