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Chapter 1

The Boundary Specification Problem in Network Analysis

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The problem of defining boundaries of social systems for study in a network analysis is discussed. We distinguish between nominalist and realist views of social phenomena and give three definitional foci for delimiting the component actors or nodes of a network: model attributes, relations, and participation in specified events or activities. A typology of boundary specification strategies is illustrated by reference to the extant network literature. Brief attention is given to formulation of inclusion rules for relations and activities or events.

In this chapter, we are concerned with an issue of central importance in the design of network studies: the problem of specifying system boundaries. From a network perspective, individual behavior is viewed as at least partially contingent on the nature of an actor's social relationships to certain key others. Likewise, the outcomes of events are seen to be partially dependent on the presence of a specific network configuration. In making use of this perspective, care must be given to specifying rules of inclusion for different network elements. Such rules pertain both to the selection of actors or nodes for the network and to the choice of types of social relationships to be studied. The latter issue is sometimes overlooked, but it is of enormous importance, especially with the development of methods for the analysis of multiple kinds of relationships.

In studies concerned with the explanation of particular events (e.g., Granovetter, 1973; Wheeldon, 1969), it is obviously of great

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consequence if a key intervening actor or "bridging" tie is omitted due to oversight or use of data that are merely convenient. Such an error, because it distorts the overall configuration of actors in a system, may render an entire analysis meaningless. Carelessness in system specification is probably a more serious issue for network analysis than for much survey analysis. Survey analyses are concerned with individual level processes thought to be uniformly applicable to each unit of analysis in some population. Incorrect system specification may result in problems such as slightly biased estimates of population means, proportions, and the like or in efficiency in statistical estimation. Misspecification will not, however, cause a fundamental misrepresentation of the process under study. The latter is precisely the outcome of errors in the definition of system boundaries in a network analysis.

In view of the potential consequences of an incorrect specification of system boundaries in network analysis, it is somewhat surprising that the published literature reporting studies of social networks shows little concern for the problem of specifying the inclusion rules used in defining the membership of actors in particular networks and in identifying the types of social relationships to be analyzed. Oftentimes the sole justification for selecting a particular portion of the "total network" (Mitchell, 1969; Barnes, 1969) for the empirical focus of an investigation has been an apparent appeal to common sense. At other times the availability of data in some published form appears to be the only basis of an investigator's claim that a set of actors linked in some way possesses an apparent "entitativity" as a self-evident natural object (Campbell, 1958). Clearly, a given empirical analysis carries conviction only to the extent that such a claim can be accepted.

In this chapter, we discuss criteria that have been explicitly or implicitly employed in defining boundaries of social networks. We will attempt to trace the consequences of assuming different rules. For instance, the use of particular inclusion rules can render the results of certain analytic procedures artifactual (see Barnes, 1979). We do not advocate any particular strategy among those we discuss; the appropriate choice of rules remains contingent on the object of explanation for a given study. We do suggest, however, that, irrespective of the solution chosen, the problem of boundary definition should be given conscious attention when studies using a network approach are designed.

As noted, network analysis have, to date, been relatively mute on the matter of boundary definition. For this reason, we have been forced to adopt an inductive approach in this review, deriving metatheoretical views on the question of network closure from an inspection of published studies of social networks. In the next section, we distinguish

two major approaches to boundary definition, the *nominalist* and *realist* approaches. We later distinguish several definitional foci used in the boundary specification process for delimiting the set of actors to be studied. We then illustrate a typology of approaches developed, by reference to extant network studies. We later discuss issues concerning the choice of particular social relationships to generate networks linking actors. Throughout, we comment on the implications of the different approaches considered for the use of analytic techniques, as well as on some unresolved theoretical issues that must be confronted if network analysis is to achieve the goal of providing new insights into social phenomena. To make our task manageable, we have paid little attention to egocentric approaches to network analysis that have been ably reviewed and explicated by Mitchell (1969) and Barnes (1972),¹ focusing attention instead on sociocentric or structural approaches.

APPROACHES TO BOUNDARY DEFINITION

The rules followed by investigators in establishing network closure or boundaries are quite varied. They range from highly diffuse and implicit notion to some quite self-conscious formalizations. It often appears that the matter of boundary definition is one of no particular import. The boundaries of a network are presented as so self-evident in a social situation studied as to require no comment (see the classic description of the bank wiring room in Roethlisberger and Dickson, 1939, or in Sampson's [1969] study of novitiates in a monastery). Other rules for establishing network limits appear to have solely an operational justification: limited resources constraining researchers to stop pursuing chains of contacts after a certain point (e.g., Travers and Milgram, 1969) or respondent recalcitrance preventing full disclosure of the actors in a network.

Nonetheless, our reading of the presently published studies suggests that researchers have generally bounded their studies in one of two ways. We distinguish between these two alternatives by referring to the time-honored controversy in the social sciences between nominalist and realist views of the ontological status of social phenomena (see Lenski, 1952; Ossowski, 1963). Having made this distinction, we hasten to add that many network studies do not fall neatly into one category or the other, perhaps because researchers have not been sufficiently self-conscious about the matter.

In the realist approach, the investigator adopts the presumed vantage point of the actors themselves in defining the boundaries of social entities. That is, the network is treated as a social fact only in that it is

consciously experienced as such by the actors composing it. Braithwaite (1959) refers to this as a phenomenalist conception of facts. For example, in Weber's (1947: 145) classic definition of a corporate group (*Verband*) as "a social relationship which is either closed or limits the admission of outsiders by rules," stress is placed on the subjective meaningfulness to participants of the bounded nature of group membership. Thus, the 800-plus students in the high school studied by Coleman (1961) clearly recognize their common membership status when contrasting themselves with students attending any other high school. The fact that any given member may not even know, let alone sustain social relationships with, all other members of the corporate group has no significance for the specification of a network inclusion rule in terms of group membership.

The realist strategy of setting network boundaries by definition assumes the proposition that a social entity exists as a collectively shared subjective awareness of all, or at least most, of the actors who are members. This assumption is not often examined empirically.² This may not be problematic in the case of studies formally constituted groups with widely agreed-upon labels such as General Motors or the University of Chicago. As one examines more informally and fluidly constituted groups, such as Whyte's (1955) street corner society, tribal societies lacking fully differentiated political and social institutions (Cohen, 1969), or ethnic groupings (Barth, 1969; Cohen, 1974; Wellman, 1979), matters become more uncertain. Consider, for example, the dormitory at the University of Michigan studied by Newcomb (1961). This had no officially constituted status beyond that of being an experimental observation site in which some students had been given housing in exchange for their willingness to submit to certain testing procedures. It is difficult to be confident that the persons thus recruited had much of the "we-feeling" characteristic of a corporate group, or that the relations they maintained with others in the dormitory were imbued with much in the way of meaning or affect. As Mitchell (1969: 13) points out in discussing sociometric studies of school classrooms, there can be danger in uncritically accepting the proposition that common-sense groupings of actors possess subjective meaning to those in them: "The behavior of individuals . . . may be affected by circumstances beyond the immediate context."

The second major approach used to define network closure is the *nominalist perspective* on social reality. Here, an analyst self-consciously imposes a conceptual framework constructed to serve his own analytic purposes. Delineation of network boundaries is analytically relative to the purposes of the investigator, and thus

network closure has no ontologically independent status. There is no assumption that reality itself will naturally conform to the analyst's distinction; the perception of reality is assumed to be mediated by the conceptual apparatus of the analyst, be he (or she) an active participant in the social scene under study or an outside observer.³

The theoretical treatment of the social system, and of social action more generally, by Parsons (1951, 1961) exemplifies the nominalist strategy. With such an approach, the match between the investigator's analytically drawn boundaries and the subjective awareness of these distinctions by participants becomes an empirical question rather than an assumption. Thus, with Marx's conception of social class (Bendix and Lipset, 1966), one begins with the nominalist concept of class-in-itself (*Klasse an sich*) and inquires into the conditions under which this will or will not be transformed into the realist grouping, a class-for-itself (*Klasse für sich*; see Rosenberg, 1953; Broom and Jones, 1977).

In addition to utilizing a nominalist or realist metatheoretical approach, investigators also set boundaries on the inclusion of actors by focusing on particular components or "primitive elements" of a network. In this next section, we discuss the ways in which these definitional foci have been used in the specification of network boundaries.

DEFINITIONAL FOCI FOR THE INCLUSION OF ACTORS

In the process of choosing a set of actors as a network, analysts focus on one or more of three sets of components: actors, relations, or activities. In part inspired by the distinction between nodes and relations in graph theory (Harary et al., 1965), studies of social networks have generally stressed the sharp analytic distinction between actors and social relationships. Somewhat less common, but important, is a third approach adopted explicitly or implicitly by other investigators in which participation in some activity or event of relevance is the criterion of membership.

The choice of a definitional focus is of importance in that it fixes certain features of a network while leaving the remaining features free to vary. It is important that an investigator's choice of definitional focus be made explicit in order to avoid circular analytic procedures leading to tautological results referring to the features fixed by the inclusion rule. For instance, it is scarcely informative to learn that a network constructed by a snowball sampling procedure is well connected or "integrated."

The most commonly used definitional tactic is that of using a restriction based on some attribute or characteristic of the actors or nodes in the network. Actors may be persons, corporate actors, or other collective entities or groupings (for example, social classes, ethnorreligious groups) that are to be treated as unique elements. Two well-worn approaches to the determination of boundaries on the inclusion of actors in this way are the *positional* approach and the *reputational* approach. In the positional approach, the membership test refers to the presence or absence of some attribute, most commonly the occupancy of a position in a formally constituted group. The reputational approach, on the other hand, utilizes the judgments of knowledgeable informants in delimiting participant actors. The two approaches to constructing a nodal inclusion rule are, of course, sometimes combined (see Laumann and Pappi, 1976).

With the adoption of some approach restricting the number of actors in a network on the basis of nodal characteristics, the nature of the interconnectedness among those actors, as well as the participation patterns of actors in events or activities, are empirically free to vary. It is, however, of little more than descriptive interest to learn about the distribution of actors on the nodal characteristics used for boundary delimitation. A second definitional focus used to select actors in network studies is that of specifying the network such that it includes those actors participating in a social relationship of a specified type. For instance, Haas and Drabek (1973: 65) suggest that organizational boundaries be drawn on the basis of interaction frequency. The relational approach to boundary definition includes the procedure known as "snowball sampling" (Erickson, 1978). In this procedure, a study initially is concerned with a small set of individual actors; the networks or chains of contact of actors in this set are traced until some criterion of termination or network closure is satisfied.

Because the relational approach to boundary definition is used rather infrequently, there appear to be few routinized methods of applying it, comparable to the positional or reputational methods for delimiting a set of actors. Seiler and Summers (1974) propose a method of locating community boundaries on the basis of interaction frequency and other measures of the degree to which places are of common relevance to one another.

Use of a relational approach to boundary definition rules out certain questions about the morphology of a network, in that the design of the study fixes or constrains these relational features. On the other hand, issues referring to the composition of the interrelated actors in terms of individual attributes, or to the participation patterns of actors, are empirical ones in a network with a relationally defined boundary.

A final element sometimes used to set boundaries is that of a defining event or activity, participation in which serves to select individual actors and the social relationships among them into a network. Pfeffer and Salancik (1978: 32) prefer this as a solution to the vexing problem of defining membership in an organization:

When it is recognized that it is behaviors, rather than individuals, that are included in structures of coordinated behavior, then it is possible to define the extent to which any given person is or is not a member of the organization. . . . The boundary is where the discretion of the organization to control an activity is less than the discretion of another organization or individual to control that activity.

The classic formulation of an inclusion rule based on participation in some activity is Dahl's (1958) decisional method for determining membership in a community elite. Of course, use of this or a related approach means that both the composition (in terms of the attributes of actors) and the relational pattern of a network are empirically at issue, while participation in the event or events on which the network is focused is predetermined.

Some investigators have stipulated inclusion rules in terms of two or more of our three definitional foci. While this may lead to theoretically elegant definitions of membership, it also has a major weakness, in that it reduces the number of problematic features to be explained given knowledge of network structure.

By cross-tabulating the distinction between nominalist and realist views with the distinctions among definitional foci drawn in this section, we arrive at an eightfold typology of boundary specification strategies. This typology is presented in Table 1.1. The cells of the typology are filled with references to empirical studies of social networks that utilize the different approaches to boundary definition. We review these in the next section.

ILLUSTRATIVE BOUNDARY SPECIFICATION STRATEGIES

The eight boundary specification approaches located on the basis of our search of the literature have been assigned Roman numerals in Table 1.1. We shall review studies illustrative of these strategies in the order indicated.

We have already mentioned the most frequently adopted realist tactic, strategy I. Here, actors are treated as nodes in a network because they are members of a group which is closed or bounded according to

TABLE 1.1 A Typology of Boundary Specification Strategies for Delimiting Actors Within a Network, With Examples

Metatheoretical Perspective	Definitional Focus for Delimitation			
	Attributes of Nodes	Relation	Participation in Event or Activity	Multiple Foci
Realist	I corporate group (Weber, 1947) bank wiring room (Roethlisberger and Dickson, 1939) monastery (Sampson, 1969) high school (Coleman, 1961; Fararo and Sunshine, 1964) Norwegian Island Parish (Barnes, 1954) cell room of Electro Zinc Plant (Kapferer, 1969) school classroom (e.g., Davis, 1970)	III primary group, clique (Cooley, 1909)	V participants in a community controversy (Dahl, 1961) participants in common social events (Homans, 1950) street corner society (Whyte, 1955)	VII <i>Klasse für sich</i> (Marx) ethnic community (Barth, 1975; Laumann, 1973; Yancey et al., 1976)
Nominalist	II <i>Klasse an sich</i> (Marx) doctors in small cities (Coleman et al., 1966) formal organizations in a small city (Galaskiewicz, 1979) American business elite (Useem, 1979) community influentials (Laumann and Pappi, 1973, 1976)	IV small world problem (Travers and Milgram, 1969; Erickson, 1978)	VI Invisible College (Crane, 1972; Burt, 1978b; Breiger, 1976)	VIII Supporters of psycho- therapy (Kadushin, 1966) National elite circles (Moore, 1979)

the Weberian (1947) definition of a corporate group. The inclusion rule for actors refers to socially defined and recognized group memberships. Examples include attendance at a particular high school (Coleman, 1961; Fararo and Sunshine, 1964), employment in a particular work group in a factory (Roethlisberger and Dickson, 1939; Kapferer, 1969), residence in a monastery (Sampson, 1969) or parish (Barnes, 1954), or assignment to a particular classroom within a school (e.g., Davis, 1970). These examples should serve to indicate that strategy I is typically applied to the study of small tightly bounded groups.

In contrast to this, strategy II, in which a nominally defined group is delimited on the basis of nodal attributes, is more often applied to larger networks. These may include hundreds or even thousands of individual actors. The actors, furthermore, are sometimes corporate actors or organizations rather than individual persons. Useem's (1979: 558) definition of the American business elite provides a good illustration of strategy II. He utilizes a positional approach, defining the elite to include "those who were directors of the 797 largest U. S. corporations in 1969." This criterion yielded a set of 8623 directors. The interrelations among these members, measured most notably by membership on two or more corporate boards, were then studied empirically.

Another illustration of strategy II is given by Galaskiewicz's (1979) study of organizations in the small city of Towertown. In this study, a territorial criterion was initially used to restrict membership within a geographical area. As a second step, a functional or industry criterion was applied:

Our target population included all industries, banks, savings and loans, newspapers, radio stations, service clubs, fraternal organizations, business associations, unions, law firms, health agencies, high schools, welfare agencies, churches, professional associations, county offices, municipal offices, and political parties. Commercial establishments, transportation facilities, public utilities, real estate offices, block clubs, community organizations, and elementary schools were excluded due to time and budget constraints [Galaskiewicz, 1979: 1350].

The rationale for including some types of organizations at the expense of others is not made explicit, but it would appear to pertain at least in part to the size of organizations.

Few empirical studies have relied exclusively on the relational nexus for determining memberships of actors in a network. We consider strategies III and IV, which use the relation as a boundary specifier, primarily for reasons of analytic completeness.

Cooly's (1909) concept of the primary group has long been a key term in small group research. The primary group is defined as a face-to-

face interacting group with diffuse positive affect. This definition is essentially relational; it requires direct linkages of positive affect among all members of a group and excludes the possibility of "isolates" claiming subjective membership in the group but lacking relations with other members. Despite its time-honored place in the sociological literature, the primary group concept has rarely, if ever, served as the basis for identifying network limits. This is perhaps because analysts with a realist viewpoint have assumed a perfect correspondence among various features of such groups: complete connectedness, subjective well-being, diffuse positive sentiments toward all members, and multiple shared activities and interests, and then focused on one of the latter three features at the expense of connectedness. In our view, however, complete connectedness remains the litmus test for a primary group.

Of course, the connectedness criterion is frequently applied in efforts to locate subgroups or "cliques" within larger networks delimited in some other manner (see, for example, Alba, 1973; Burt, 1978a). Subgroupings identified in this way are often believed to have an ontological status distinguishing them in socially significant ways from other actors in the larger network to whom they are more loosely and indirectly connected. Here, then, we have a combination of strategies I and III, with the former being used to delineate the inclusive network and the latter to define cliques within it. Methods for locating subgroups on the criterion of structural equivalence proceed in a similar manner (Lorrain and White, 1971; White et al., 1976; Burt, 1978a).

Studies of the "small world" problem (e.g., Travers and Milgram, 1969) provide a good illustration of strategy IV. Here, arbitrarily selected "starters" serve as initiators of chains intended to reach arbitrarily selected "target" persons by way of preexisting personal relationships. The inclusion rule is thus specified in terms of an actor's presence in a chain of ties of unspecified type. Both the attributes of the individuals in the chain and the content of the relations composing it are theoretically and empirically free to vary given this inclusion rule (see Lin et al., 1978), and empirical variation in nodal characteristics may be used in efforts to discriminate between chains which are successful in reaching the intended target and those which are unsuccessful.

Strategy V, in which an actor's inclusion in a network is defined in terms of participation or interest in one or more event, activity, or concern is the primary alternative to strategy I from the realist perspective. Homans (1950: 82-86) provides a classic instance of this strategy, drawn from the field work of Davis et al. (1941, esp. 147-156). A clique structure among 18 women was induced from information about their participation in 14 informal gatherings taking place over the course of several months. Similarly, Dahl (1961), in a quite self-

conscious application of strategy V, specifies three community controversies in the city of New Haven as a basis for locating community influentials. In a somewhat more implicit fashion, Whyte's (1955) description of street corner society in an Italian-American neighborhood of Boston uses the physical setting of a particular street corner as a focal observational scene or frame (see Goffman, 1974) for identifying nodal elements of the "society" (see also Leibow, 1967; Anderson, 1978).

Researchers adopting a nominalist perspective have been somewhat more reluctant than the realists to employ an event-focused approach to boundary delimitation. Most notable in illustrating strategy VI is work on "invisible colleges" of scientists (Crane, 1972; Burt, 1978b), in which network members are identified on the basis of their interest in a particular field of research, irrespective of their disciplinary label. The membership criterion in Breiger's (1976) study of biomedical researchers is publication of one or more articles in the research area on which the "invisible college" is focused.⁴

The three definitional foci for boundary delimitation can be and are combined in some cases (strategies VII and VIII). An example from the realist perspective is the Marxian concept of classes for itself (*Klasse für sich*), which simultaneously requires occupancy of a common position relative to the means of production, relations of solidarity with those in the class, recognition of the attendant interests implied by objective position, and establishment of a self-conscious political organization in pursuit of those interests. Similarly, in delimiting an ethnic community, some investigators require both the nodal feature of a common heritage and the presence of a disproportionate level of interaction among members in terms of intimate social relations such as marriage or friendship (Laumann, 1973; Barth, 1975). Thus Yancey et al. (1976: 399) assert that

ethnicity defined in terms of frequent patterns of association and identification with common origins . . . is generated and becomes crystallized under conditions of residential stability and segregation, common occupational positions and dependence on local institutions and services.

The discussion of social circles by Kadushin (1966, 1968) in some ways combines elements of the realist and nominalist perspectives and is therefore intermediate between the application of strategies VII and VIII. Kadushin defines social circles analytically, in terms of the sharing of certain broadly conceived social or political interests, together with

the presence of indirect relational connectedness to other members. He asserts, however, that groups thus defined are real social entities. Hence, in describing a social circle called the Friends and Supporters of Psychotherapy, he writes that "like all circles, the Friends do not have a listing in the telephone book, but only in that sense are they a non-existent social unit" (Kadushin, 1966: 792).

In his actual analysis of data, Kadushin attempts to locate social circles within a group delimited on the basis of a nodal attribute (having made an application to the psychiatric clinic) using latent structure analysis of items measuring participation in certain types of cultural events and information levels concerning psychotherapy. His purpose in doing this is to "define circles empirically without necessarily having to engage in extensive and difficult sociometric analysis" (Kadushin, 1966: 792). This is obviously an important operational advantage if there is a sufficiently close correspondence between the participation and knowledge measures and the unmeasured connectedness criterion. The procedure may be problematic in the absence of a close correspondence, and others have chosen operationally to define circles otherwise (e.g., Alba and Moore, 1978).

Moore's (1979; see also Alba and Moore, 1978) study of the American national elite is more clearly representative of the application of strategy VIII. The study design for identifying this elite involved an initial selection of 545 incumbents of command positions in key institutional sectors of American society, supplemented by another 331 persons identified on the basis of a reputational survey of the initial positionally identified group, and a snowball sampling procedure (see Moore, 1979: 675-676).

Laumann and Marsden (1979) utilize multiple foci for defining "collective actors" within oppositional structures in political systems; i.e., for defining subgroups within networks delimited on some other basis. They define a collective actor in terms of individual members who "(1) share an outcome preference in some matter of common concern, and (2) are in an effective communication network with one another" (Laumann and Marsden, 1979: 717).

As mentioned earlier, the central difficulty with strategies VII and VIII is that in using two or more analytic features of networks to define membership of actors in the network, these strategies consume many theoretical degrees of freedom. Great caution must be used in drawing substantive inferences here. For instance, Moore's (1979) study concludes that the structure of the American elite is that of a large, integrated collection of interrelated actors rather than a set of

fragmented groups. Despite her explicit attention to the issue (Moore, 1979: 677), the reader is left with the suspicion that her conclusion is necessitated, or at least made likely, by the boundary specification rule employed: The selection of certain institutional sectors (e.g., mass media leaders) carries strong relational implications; the use of snowball sampling requires connectedness among at least some members of the network; and the granting of discretion to respondents to select national events as discussion topics, and to give an unlimited number of responses to sociometric questions, in all likelihood encouraged the recognition of diverse and ramifying communication ties.

This concludes our review of strategies for delimiting boundaries of a network as far as actors are concerned. This is, to our minds, the most central issue in boundary specification, and it is certainly the issue that had received the most concerted attention. It is also of importance, however, to consider rules of inclusion for the other two analytic foci we have mentioned: relations and events or activities.

ON INCLUSION RULES FOR RELATIONS

The identification of the social relationship as a definitional focus, together with the development of analytic techniques permitting consideration of multiple types of relationships (White et al., 1976; Burt, 1977b) points to the need for developing rules of inclusion for relationships studied, as well as actors. A major barrier in this enterprise is the current lack of any well-articulated typology of social relationships that could lead to the development of explicit selection strategies parallel to those reviewed earlier for actors. Probably the best guidance we have available in this regard is derived from Parson's (1951) set of five pattern variables. Particular attention has been given to the distinction between instrumental and expressive social relations; somewhat more implicit is a focus on the diffuseness-specificity dimension.

Even with a suitable classification of relationships, however, an analyst is left with the problem of selecting types to be analyzed. Rather little self-conscious attention appears to have been given to this matter; implicit appeals to common-sense justifications for the use of particular relations as generators of a social structure or analyses of any available relational data run rampant. Probably the most serious consequence of such neglect is what we shall term the *partial system fallacy*. This is present wherever a set of relationships connecting a subset of the actors to which the relations are relevant is analyzed without prior attention to the entire set of actors. The result of such a procedure may be a seriously misleading description of network structure.

To clarify this point, we refer to an illustrative case with which we have some familiarity, pertaining to the social structure of a community defined in terms of interorganizational relations (see Laumann et al., 1978). Consider two specific types of interorganizational relations: transfer of money and transfer of information pertinent to local community affairs. If the boundary for inclusion of organizations has been drawn on the basis of geography, then the analysis of social structure in terms of intracommunity money flows may be uninformative. This is because many of the central organizations in the total network of money flows would be excluded from the network by virtue of the geographically based nodal inclusion rule. Examples of the excluded organizations would be state and federal government agencies, extralocal banks, headquarters or subsidiary organizations located elsewhere, and supplier and consumer organizations. For many, or even most, local organizations, these might be more important sources or destinations of money than other organizations in the locality. Their omission from the network of money flows makes the analysis of such flows subject to the partial system fallacy. We would be more comfortable with an analysis based on information flows pertinent to community affairs. Because these relationships are defined with explicit reference to a criterion of common relevance to the organizations delimited on the basis of the nodal inclusion rule, it is plausible to treat the patterns of information flow analytically as a closed system, while such a treatment is implausible for the money flows.

Two other issues raised when we consider inclusion rules for relations are of special concern to multiple network studies using structural equivalence as a central concept. The procedures outlined by White et al. (1976) are premised on the idea that social roles can be understood by simultaneously considering, or "stacking," several different relations or generators. Blockmodels of roles and positions are either induced by clustering nodes on the basis of the profile similarities across the multiple relations (Breiger et al., 1975) or deduced by searching for "empty places" in the network (Heil and White, 1976). This approach has led to some interesting analyses of social structure (e.g., Breiger, 1976; Snyder and Kick, 1979). This approach does, however, place an obligation on investigators to be explicit regarding the rationale for merging different generators in a single analysis—that is, to indicate why these particular relations ought to be seen as jointly definitive of social roles in a given population. In some applications it appears that the social positions induced by the procedures mentioned have been arbitrarily determined by the happenstance availability of particular generators. This appearance is accentuated by the inability of some

analysis to find a meaningful substantive interpretation of the partitions of actors identified.

In our view, some potential generators ought not to be used at all in the definition of social positions or roles, because to use them is to commit the partial system fallacy discussed above. In other cases, it may be preferable to utilize multiple network strategies like those advocated by Burt (1977b). In this approach, several different sets of social positions or roles are induced on the basis of social relationships considered separately; the intersections among the different partitions of actors into positions are then analyzed empirically.

One final point pertaining to multiple network approaches and the setting of boundaries on the inclusion of relations is of particular importance to those approaches and techniques assigning special weight to the absence of social ties as a criterion for locating social structure in networks. When applied to small, closed groups, these methods have been quite successful. As increasingly large networks are analyzed, however, the fact that any given actor is capable of maintaining only a limited number of ties, together with the well-known generalization that the total number of ties increases as the square of the number of actors, creates a fundamental ambiguity about the absence of relations. Absent ties may appear either because of active avoidance or limited opportunity for contact. The implication of this is that in efforts to apply techniques resting on the notion of structural equivalence to large networks, care should be taken to obtain multiple measures that permit the analyst to discriminate between avoidance and lack of contact (see, for example, Breiger's [1976] study of awareness relations among biomedical scientists, or the analysis by White et al., 1976, of positive and negative relations of affect, influence, and so forth in a monastery studied by Sampson [1969]).

BOUNDARY SPECIFICATION FOR ACTIVITIES

We shall comment briefly on the question of setting limits on the inclusion of events, activities, or interests in network studies. It is obvious that the network boundaries for the inclusion of actors obtained using strategies V and VI are entirely dependent on the selection of particular events or activities as ones of focal interest. An analytic rationale for event selection is generally *not* given by those applying these strategies.⁵ It is often assumed that the relevant events are self-evident to any well-informed observer. This gives an unfortunate impression of arbitrariness, which leaves the reader to inquire what shape the leadership and power structure of New Haven might have

taken had Dahl (1961) and his associates chosen to study additional or other issues, or what changes in the clique structure of women in Old City might have emerged if other social gatherings that doubtless occurred during the observation period of Davis et al. (1941) had been mentioned in the newspapers or noticed by the participant observers.

Part of the issue here is whether an analyst is intrinsically interested in the events under study, or whether their selection is an intermediate step in an effort to obtain a description of a regularized structure of social relations among actors. In the former case, a rationale for event selection is straightforward and obvious. We are more concerned with the latter case. When the goal is to obtain a description of a presumably enduring social structure using an event-base strategy for boundary delimitation, steps should be taken to carefully delineate the event space to be explored.

Unfortunately, this problem is more easily posed than solved. As in the case of boundary specification for relations, the development of a workable typology of issues or activities that might be used for sampling or selection of focal events would be a useful first step toward a solution. Aside from referring to our previously published commentary addressing this problem (Laumann et al., 1977), and to some efforts in the literature to develop classification schemes for issues (Barth and Johnson, 1959; Freeman, 1968; Molotch, 1976), we have little guidance to offer on it.

CONCLUSION

In this chapter we have reviewed approaches to the problem of setting network boundaries. While we feel that network analysis has a great deal to offer social scientists seeking to study social systems, we think it important to emphasize the point that *there is no sense in which social networks must "naturally" correspond to social systems*. Freeman (1980) gives elegant formal criteria, in terms of nodes, relations, and attributes, for defining social networks. Adopting a nominalist view, we define a social system as "a plurality of actors interacting on the basis of a shared symbol system" (Parsons, 1951: 19). The problem of boundary specification in efforts to adapt network analysis to the study of social systems is essentially that of specifying the standard of common relevance (Newcomb, 1961: 12-23)—that is, the basis of mutual orientation for actors—which circumscribes membership in the system. Given a suitable definition of this standard, the network boundaries for actors, relations, and activities or events may be specified such that they can be plausibly equated to those of the social system under study.

Boundary specification also lays a basis for the identification of sets of social roles in that system, with respect to both its internal organization and its environment.

The question of boundary specification has received comparatively little attention in the past decade during which network analysis has largely come into its own, partly because of the preoccupation of the field with the development of novel strategies for analysis of relational data. It is a much less tractable sort of problem than those addressed by some of the chapters concerned with analytic methods included elsewhere in this volume, and one on which there are few objective criteria that may be used to resolve conflicting positions. We have argued here, however, that networks can be meaningfully understood only in terms of the elements of focal interest used to define membership, whether that usage is explicit or inadvertent. We feel that more explicit attention to boundary specification will contribute to the success of network methods in the study of social structures and systems as new studies are designed and new data collected.

NOTES

1. Because they anchor a network on a focal individual or set of individuals of interest to an investigator, egocentric approaches to network analysis avoid some of the problems of boundary delimitation that we note for sociocentric approaches. Even here, issues arise about the lengths to which an investigator must go in identifying relevant indirect ties that might affect the attitudes or behavior of the focal actor. The problems are pragmatic as well as theoretical: Boissevain (1974), for example, enumerated a set of over 1000 persons related in some fashion to an "ordinary" person in the island society of Malta. Mitchell (1969) and Barnes (1969) suggest that in practice it is rarely necessary to inquire into indirect ties involving more than one intermediary. In Barnes's terminology, inspection of the "primary" and "second-order" zones is usually sufficient. Thus, a "stopping rule" used to establish network closure is obviously a necessity for egocentric as well as structural approaches, but we shall not consider such problems here.
2. For research strategies relevant to assessing this hypothesis, see Laumann and Senter (1976), Broom and Jones (1977), or Gurtin et al. (1980).
3. What we have called here the *nominalist* approach to boundary definition appears to correspond to Braithwaite's (1959) *realist* view of social facts as things accessible to some falsifiable method of observation, irrespective of whether they are experienced as facts by participants. It also reflects Kaplan's (1964) *instrumentalist* view of the nature of theories and concepts, seeing these as the investigator's tools of inquiry rather than as necessarily accurate pictures or maps of the world.
4. The researchers actually studied by Breiger were sampled from a population delimited by the criterion given here.
5. Consider, for instance, the advice given to those wishing to apply a decisional method of locating leaders by Polsky (1960: 495), who suggests that issues "which are generally agreed to be significant" be studied.