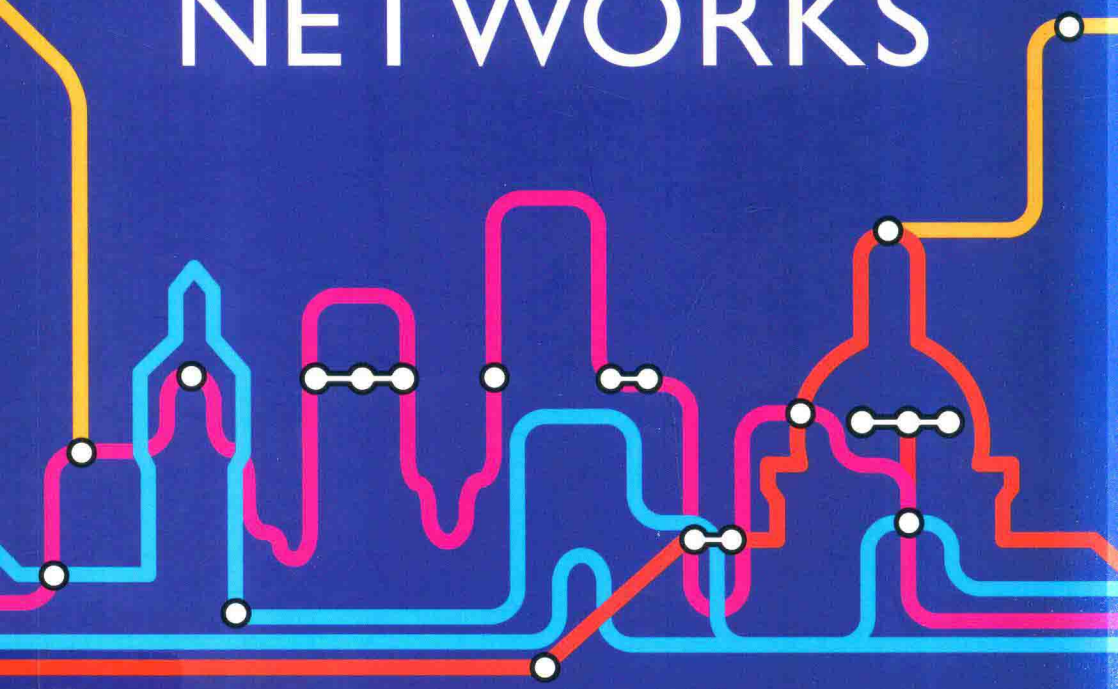
KATHERINE GIUFFRE

COMMUNITIES and NETWORKS



Using Social Network Analysis to Rethink Urban and Community Studies

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Contents

1 What is network analysis and how can it be useful?

Humans are inherently social beings. We have lived in communities as long as we have been human. We form communities and, in many ways, communities form us. Our lives in communities shape who we are and how we approach the world. Understanding how communities work is vital to understanding our lives, but communities are complex and analyzing them can be difficult. They are spaces both of cooperation and of conflict. They can give us both a sense of belonging and one of alienation. They can root us in a place and also allow us to transcend the confines of geography.

For example, in the 1690s the Puritan village of Salem, Massachusetts, erupted in a paroxysm of witch-hunting the likes of which had never before been seen in North America. In the 1930s, community after community of solid citizens in Germany turned on their neighbors and succumbed to Nazism. What was happening at the level of the community to make the citizens of these places behave in these ways?

In the early twentieth century, Jewish immigrants from Eastern Europe to Chicago gradually assimilated into the American culture. In the late twentieth century, however, Indochinese refugees to Boston were the victims of arson by their neighbors who wanted the Indochinese out of their community. How and why do different communities react differently to the presence of outsiders in their midst?

In the 1960s, the residents of the ghetto in Washington, DC, responded to the assassination of Rev. Martin Luther King, Jr., with days of riots and looting. In the 1980s, the residents of New York City responded to the AIDS crisis by building a broad network of organizations intended to respond to a wide-ranging population of people in need. How and why does crisis elicit such different responses from different communities?

Community members can provide social support for each other in a variety of ways and that support can play a part in, for example, the explosion of innovative thinking that characterized Silicon Valley at the end of the twentieth century. But community members can also exert enormous pressure on each other to conform to established traditions, customs, and ways of thinking or risk being ostracized from the group and all of the social goods that it provides. How do members of communities navigate this tension between support and suffocation? Are there new types of communities emerging in the twenty-first century that are better able to maintain the balance between having too much community support and having too little?

These examples illustrate some of the ways in which communities are complex, many-faceted phenomena. Analyzing communities and communal life, therefore, is fascinating, but can at times seem overwhelming. Social network analysis helps make sense of all of this. Using social network analysis to look at community structures can give us a new perspective, new insights, richer understanding, and surprising answers to questions like the ones above and many more. The rise of social network analysis in the past half century has opened up wide ranges for exploring the questions of how human life is organized on a variety of levels and in a variety of disciplines. This book will look at how incorporating network analysis into urban and community studies can help us to understand questions and issues in those fields and can lead us to think about problems in new and fruitful ways.

What is structure?

Network analysis is the study of structure. But what do network analysts mean when they use the term "structure"? Berkowitz writes that "[t]he idea that social systems may be *structured* in various ways is not new. In fact, all of the established social sciences have evolved some notion of *structure*. But, until recently, no field had taken the idea of a *regular, persistent pattern in the behavior of the elementary parts of a social system* and used it as a central or focal concept for understanding social life" (1982: 1, emphasis in original). Wasserman and Faust add, "Regularities or patterns in interactions give rise to structures" (1994: 6–7).

What this means in the context of network analysis is that the persistent patterns of *relations* among the participants in a system

become the core of the analysis. It is the relationships between the members of the system rather than the individual *attributes* of those members that are the key component of understanding the system. For example, network analysts would focus on the web of relations among various artists and galleries (rather than, say, the talent of individual artists) in order to understand why some artists find success in the art world and others do not (Giuffre 1999). The logic behind this thinking is part of our everyday understanding of how the world operates when we say things like, "It's not what you know; it's who you know." Network analysts do not stop at merely "who you know," however, but investigate much more deeply into the persistent patterns of those relationships. These patterns of relationships are what we call "structure" (Wasserman & Faust 1994: 3).

Much social science research in a variety of fields focuses exclusively on individual attributes (like talent, in the example above) and ignores important information about the patterns of relations among the members of the system (Wasserman & Faust 1994: 6–7). Network analysts, however, argue that "structural relations are often more important for understanding observed behaviors than are such attributes as age, gender, values, and ideology" (Knoke & Yang 2008: 4).

Social network analysis, then, concentrates on relations among the members of a system rather than on the individual attributes of those members. This is because patterns of relations have consequences. Again, this is the kind of everyday thinking we employ when we say that people looking for jobs should "activate their networks," or that the "environment" in Silicon Valley is conducive to producing innovative thinking, or that the American economy suffered as the country lost its "position of dominance" in the system of global trade, or even that a friend going through a difficult time needs others to rally around with emotional support. In fact, one of the earliest examples of the type of work that we now think of as network analysis was Moreno's 1934 study of how the "social configurations" surrounding individuals affected their psychological well-being (Moreno 1934). More generally, "[t]he central objectives of network analysis are to measure and represent these structural relations accurately, and to explain both why they occur and what are their consequences" (Knoke & Yang 2008: 4).

Because the relations among the members of a system can have profound consequences, it is important to understand how those

relations fit together – how they are structured. Network analysts, therefore, gather data on the *relations* among the actors as their primary source of information. This relational data, Scott writes, is "the contacts, ties and connections, the group attachments and meetings, which relate one agent to another and so cannot be reduced to the properties of the individual agents themselves. Relations are not the property of agents; these relations connect pairs of agents into larger relational systems" (2000: 3).

Relational data is not about the individual members of a system (who have relations), but about relations (which occur among members of a system.) This difference may seem trivial (or even non-existent), but it is really a change in worldview, bringing the importance of the structure of relations to the fore in our understanding of how the world works. Focusing on the structure of the relations rather than on the attributes of the parties in those relations is the key to understanding network analysis. Wasserman and Faust note that "[o]f critical importance for the development of methods for social network analysis is the fact that the unit of analysis in network analysis is not the individual, but an entity consisting of a collection of individuals and the linkages among them" (1994: 4–5).

Networks as metaphors

Although the methods by which we can analyze relational data are relatively new, relational thinking has a long history in the social sciences. As far back as 1845, for example, Marx wrote in the *Theses on Feuerbach*: "VI: Feuerbach resolves the religious essence into the human essence. But the human essence is no abstraction inherent in each single individual. In its reality it is the ensemble of social relations" (Marx 1978 [1845]: 145). That is, Marx argues that it is our relations with others – our real, lived relations – that make us who we are.

In the early twentieth century, the work of Georg Simmel pushed the relational thinking behind network analysis to new heights. Simmel, one of the founders of the field of sociology, wrote prolifically on the relationship between individuality and social forms, especially during the transition to modern urban life. Simmel's idea of the development of individuality (discussed in more detail in chapter 2) is based on a notion of the dynamic between social circles and individuals with each forming and being formed by the other. Simmel's

study of these social forms – which he referred to as the "geometry" of social relations – was the basis of "formal sociology." The "forms of sociation" are made by individuals who are tied together in relations. Simmel particularly concentrates on *exchange* as the form of interaction through which society is formed; religion, economy, and politics, he argues, are all based on exchange. "Exchange," he writes, "is the purest and most concentrated form of all human interactions in which serious interests are at stake" (Simmel 1971: 43). Social circles are themselves formed by these interactions – we are linked together through exchanges. We can see here the basis of the idea that networks are formed by relations between actors and that these networks have consequences. For Simmel, the creation of society itself is the result of these exchanges.

Simmel argues that exchange "lifts the individual thing and its significance for the individual man out of their singularity, not into the sphere of the abstract but into the liveliness of interaction" (1971: 69). This relational thinking, especially the primacy given to the role of exchanges between individuals, played a key role in the later development of network analysis. The "geometric" mindset brought relational thinking more clearly into focus.

But at first, Berkowitz notes, networks "were employed as little more than metaphors for the things social scientists were really trying to deal with: a friendship group was *like* a 'star' with one central point; a work group was *like* a small 'pyramid'; or the spread of a rumor was *like* a 'chain'" (1982: 2). While these metaphors helped social scientists conceptualize more clearly about the phenomena that they were studying, to truly be able to analyze in detail the spread of actual information through actual networks, social scientists needed more than just compelling metaphors; they needed method.

The relational thinking exemplified by Simmel was part of many disciplines in the social sciences, but it was an anthropologist, John A. Barnes, who is usually credited with first using the term "social network" in 1954 (Wasserman & Faust 1994, Knoke & Yang 2008) in his study of a Norwegian island parish. Barnes drew on Moreno's work on "social configurations" and emotional well-being (mentioned above) and, specifically, on Moreno's ground-breaking tool for analyzing these configurations: the sociogram (Moreno 1934). It was the advent of the sociogram that allowed network thinking to move from metaphor to method.

Metaphor into method

A **sociogram**[1] is a picture of a **network** of relations, where the members of the network are represented by points and the relations between them are represented by lines connecting the points. The map in the back of an airline's in-flight magazine showing the airports connected by the airline's flights is an example of a sociogram, for instance. So is the organizational chart of a company showing the chain of command in decision making or a family tree showing kinship connections. Sociograms are familiar to us now – so familiar, in fact, that it is difficult for us to conceive of the revolutionary impact that Moreno's work had in the social sciences. "Before Moreno, people had spoken of 'webs' of connection, the 'social fabric' and, on occasion, of 'networks' of relations, but no one had attempted to systemize this metaphor into an analytical diagram" (Scott 2000: 9–10).

Once the analytical diagram had been developed, it was available for analysis along a number of different lines. The mathematics for the analysis came from graph theory. Graph theory is the mathematical study of graphs, which (not to be confused with bar graphs, pie charts, and other types of graphs that we think of colloquially) are simple structures consisting of a set of vertices (represented by points in a sociogram) some of which are connected by edges (the lines connecting the points in a sociogram.) Edges may have additional characteristics such as direction (going from one vertex to another and not simply connecting two vertices) or color or weight. Topological techniques in graph theory yield results about the coarse properties of graphs, such as when they are connected, have certain special paths (Eulerian or Hamiltonian, for example), or can be colored with a certain number of colors. Probabalistic, linear algebraic, discrete geometric, and other, purely numerical techniques can answer questions about **densities** of edges (that is, the proportion of actual ties which exist in the network) in certain graphs, the rate of propagation of some kind of signal through a graph, or of the solutions of differential equations defined on a graph, for example. Often a graph is used as a simplified version of a complex situation (such as in geometry or differential equations) where results about the graph

[1] Network terms that appear in **bold** when they are first discussed in the text are defined in the glossary.

will give approximate answers to the full, original problem. Graph theory has been extensively used in computer science to model communications networks, the connections on a single computer chip, the relationships between the components of a large software system, and so on. Graph theorists can analyze not only a sociogram, but also the translation of a sociogram into a *matrix* (see below). Graph theory provided the mathematical method to analyze social networks.

What is a social network?

A social network is a type of graph – a set of vertices and edges. Or, less abstractly, a social network is composed of a set of actors and the relations among them. What, then, is an "**actor**" and what constitutes a "**relation**" between actors?

"Actors" can be any social entity that is engaged in interaction with others of its type – individual persons can be actors in a network, and so can small groups like families, larger groups like civic organizations, bigger groups like corporations or even nation-states. Actors can be much more than people sharing friendships mediated through a "social networking" site like Facebook. Some examples would be workers in a tailoring shop in Zambia who attempt to organize a strike (Kapferer 1972), composers working in the Hollywood film industry (Faulkner 1987), monks forming cliques in a monastery (Sampson 1969, White et al. 1976), families vying for political dominance in Renaissance Florence (Padgett & Ansell 1993), corporations connected by shared board members (Useem 1978), public and private agencies engaged in interagency collaboration to improve school safety (Cross et al. 2009), political parties forming coalitions (Centeno 2002), or nations importing guest workers from other nations (Massey et al. 2002).

Actors are all members of the system being analyzed, but they do not necessarily all have relations with each other. Some composers working in the Hollywood film industry may work together on projects repeatedly; some may never have any contact with each other. Some countries may be active trading partners; some may have no relations of any kind. Moreover, although network analysts use the term "actors" for the members of the network, that does not necessarily mean that they "act" or that they have agency. Family members in a kinship network "act" merely by being born. Some artists are "actors" in the art world by failing to get gallery representation – by

being ignored and unable to form **ties**. Actors are represented as points or "**nodes**" in a sociogram. The lines that connect the actors represent their "relations".

Actors are tied together by specific types of relations. These ties can be almost anything. When we think of social networking sites, we often think of individual people being tied together through friendship ties, but individuals could also be linked together by kinship, by belonging to an organization together (as in Useem's [1978] corporate interlocks), by attending events together (as Davis et al.'s [1941] club women did), by disliking each other (as some of the monks in Sampson's [Sampson 1969, White et al. 1976] monastery did), or by a whole host of other types of relations. On a larger scale, nations, for example, could be tied together by shared trade or diplomatic relations, by links of tourism, by sending and receiving guest workers and so on. Once we define what particular type of tie we are studying, we can then see which pairs of actors in the network are linked together by sharing a tie of that type (Wasserman & Faust 1994: 18–20). Two actors in a network that are tied together are called a "**dyad**" and the dyad is the most basic building block of a network.

Like the edges that graph theorists studied, ties can have properties such as direction and **strength**. A tie is directionless when it is mutual; I am related to my cousin in the same way that she is related to me, for example. But some ties have direction – they are sent from one node to another. An employer pays an employee and not the other way around. A boss directs an underling. Even ties such as those of friendship or affection may have direction – think, for example, of unrequited love. Ties can also have strength. I can be acquainted with someone, be friends with him, or be the very best of friends with him. Nations may engage in no trade with each other, engage in some trade with each other, or be primary trading partners.

It is important to remember that these properties are properties of the *tie*, not of the actor. It is only by looking at the flow of goods and money *between* two countries that we can tell if they are strong partners or not.

Further developments

Simmel's formal sociology and the relational thinking that underlay it had an enormous impact on the development of social science in the twentieth century. Further advances were made in the 1950s

by a group of anthropologists at Manchester University, including John Barnes (who first used the term "social network," as mentioned above), Clyde Mitchell, and Elizabeth Bott (whose work will be discussed in much greater detail in chapter 3). These researchers concentrated on specific case studies and developed many network analytical concepts, tools, and terms to help them describe and explain the social structures that they uncovered. These empirical studies laid the groundwork for further methodological and theoretical developments that began to appear in the 1960s and 1970s – especially from Harrison White and his students at Harvard.

It is impossible to overstate the importance of White to the development of social network analysis. There were three especially important parts of White's work: the development of algebraic methods for dealing with structure, the development of multidimensional scaling, and the training of a generation of important network researchers (Scott 2000, Berkowitz 1982.)

Using algebraic methods, White and François Lorrain developed a technique for identifying **structurally equivalent** nodes. (We will discuss structural equivalence in depth in chapter 6.) Using structural equivalence to reduce networks to models allows researchers to compare structures and positions across different networks. "Lorrain and White's method was able to realize, for the first time, all of the power implicit in the social network concept. First, it operated simultaneously on both nodes and relations. . . . Second, it enabled researchers to deal with a given network at all levels of abstraction" (Berkowitz 1982: 5). The second technique, multidimensional scaling (which we will discuss in detail in chapter 8), is a method for mapping social distances onto geographic space. Like structural equivalence, multidimensional scaling allows researchers to build models based on the actual relations between actors in the network rather than having to impose a priori categories and understandings on the social world before beginning to analyze it. Network analysts now had methods by which they could compare positions across networks, compare network structures, build models to explain and understand action, and so on.

White was also responsible for training future generations of network researchers who produced some of the most important and ground-breaking network studies. For example, Granovetter's study of the strength of weak ties (discussed in chapter 4), Lee's study of women seeking illegal abortions (discussed in chapter 3), Wellman's