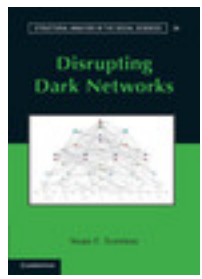

Disrupting Dark Networks

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Book DOI: http://dx.doi.org/10.1017/CBO9781139136877

Online ISBN: 9781139136877

Hardback ISBN: 9781107022591

Paperback ISBN: 9781107606685

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Chapter DOI: http://dx.doi.org/10.1017/CBO9781139136877.003

Cambridge University Press

1

Social Network Analysis: An Introduction

1.1 Introduction

While notions of social structure can be found in the writings of classical social theorists such as Auguste Comte, Emile Durkheim, Karl Marx, Herbert Spencer, and Max Weber, Georg Simmel is generally seen as the intellectual forbearer of social network analysis (SNA). Simmel ([1908] 1955, [1908] 1971) argued that to understand social behavior we must study patterns of interaction, and he offered penetrating insights into the nature of secret societies (1950b), the differing dynamics of dyads and triads (Simmel 1950a, c),[1] how increasing social complexity has led to concomitant rise in individualism ([1908] 1955), as well as others. While Simmel's theoretical contributions continue to influence the discipline today, SNA's early formal development can be traced to two major strands (Prell 2011; Scott 2000): the work of (1) social psychologists, such as Fritz Heider, Kurt Lewin, and Jacob Moreno (Heider 1977; Lewin 1951; Moreno 1953), who emphasized how organized patterns shape how we see and interpret the world; and (2) social anthropologists, such as Siegfried Nadel (1957) and Alfred Radcliffe-Brown (1940), who focused on the relationship between social patterns and social structure and who, in turn, influenced the research of social scientists such as Elton Mayo (1933, 1945; see also Roethlisberger and Dickson 1939), W. Lloyd Warner (Warner and Lunt 1941), John Barnes (1954), Elizabeth Bott (1957), and J. Clyde Mitchell (1969). These individuals did not create a distinct SNA paradigm, but their efforts laid the groundwork for its development at Harvard in the 1960s and 1970s, in an effort led by sociologist Harrison White and his students, including Ronald Breiger, Ivan Chase, Bonnie Erickson, Mark Granovetter, Michael Schwartz, and

[1] A dyad is a pair of actors with a tie between them. A triad is a set of three actors that may or may not have ties among them.

Barry Wellman (Freeman 2004; Prell 2011; Scott 2000). White, who also earned a Ph.D. in theoretical physics, emphasized the need for an empirically based social science that unapologetically focused on social phenomena. He argued that sociology, in spite of its claims to study social phenomena, was beholden to individualistic forms of analysis that drew conclusions based on the aggregated characteristics of individuals, often aided by statistical analysis of survey data. This, he believed, was a mistake. Thus, along with his students, he developed an approach that drew on case studies to focus on social relations and the patterns that emerge from them. The result is what we now know as social network analysis, and the discipline has blossomed ever since (Freeman 2004; Prell 2011). Social network analysts have created their own organization (International Network for Social Network Analysis), launched their own journals (*Connections*, *Social Networks*, and the *Journal of Social Structure*), gathered annually in either North America or Europe (Sunbelt meetings), and produced a number of monographs on SNA (de Nooy, Mrvar, and Batagelj 2005, 2011; Degenne and Forsé 1999; Knoke and Yang 2007; Scott 2000; Wasserman and Faust 1994).[2]

In recent years physicists and other scientists have entered the field, which has helped lead to an increased interest in SNA, attracting researchers from a wide array of disciplines and generating a number of highly creative studies (see, e.g., Barabási 2002; Barabási and Albert 1999; Buchanan 2001, 2002; Girvan and Newman 2002; Kleinberg 1999, 2000; Onnela et al. 2007; Watts 1999a, b, 2003). Unfortunately, many of these network scientists have been unaware of SNA's rich theoretical history (Scott 2011), which has led to a split in the field and the unnecessary replication of previous research:

> The physicists Barabási and Albert, for example, reported a "new" result having to do with the tendency of nodes in a network to display gross inequalities in the number of others to which they are linked. And they went on to develop a model designed to explain that tendency. But Paul Lazarsfeld had described the same tendency in 1938 (Moreno and Jennings 1938),

[2] The story, of course, is more complex than this brief account. For example, faculty and students at University of California, Irvine, made significant contributions (Freeman 2004:155–158). In fact, one faculty member, Linton Freeman, developed the first version of UCINET, probably the most widely used social network software in the world, and one of his students, Stephen Borgatti, along with Martin Everett, has since taken over its development. Other traditions that have informed SNA include graph theory (Harary 1953, 1969; Harary and Norman 1953; Lewis 2009), exchange theory (Cook and Whitmeyer 1992; Emerson 1972a, b, 1976), and research into the recruitment of individuals to religious and social movements (Gould 1991, 1993a; Lofland 1977; Lofland and Stark 1965; McAdam 1986, 1988b; Snow and Phillips 1980; Snow, Zurcher and Ekland-Olson 1980).

> and Derek de Solla Price had developed essentially the same model as early as 1976. (Freeman 2004:166)

Nevertheless, there are signs that the two communities are bridging the gap. Duncan Watts, for example, took a position in the sociology department at Columbia University, and network scientists routinely attend the annual Sunbelt meetings (Freeman 2004). Thus, the long-term prospect for collaboration between the two groups looks promising, which will undoubtedly lead to further advances in the field.

What exactly is SNA? Briefly, it is a collection of theories and methods that assumes that the behavior of actors (whether individuals, groups, or organizations) is profoundly affected by their ties to others and the networks in which they are embedded. Rather than viewing individuals (and groups and organizations) as unaffected by those around them, SNA assumes that we are social beings whose interaction patterns affect what we do, say, and believe. Interaction patterns are anything but random, of course. Actors tend to interact with similar others, and repeated interaction can lead (among other things) to the emergence of social formation at the micro (e.g., individual), meso (e.g., group), and macro (e.g., institutions, nations) levels that can be the object of SNA in their own right. Intense social interaction can generate feelings of group solidarity, norms of behavior, symbols of group belonging (e.g., team mascots, gang colors, national flags, sacred religious symbols such as the Christian cross and the Jewish star, etc.), and a sense of identity (Collins 2004; White 1992, 2008). All of this is just a fancy way of saying that social networks not only enable and constrain behavior but that they are also chock-full of meaning (White 1992, 2008),[3] and as such help us make sense of our world, shape our preferences, and influence the choices we make (Passy 2003:23). Consequently, a primary goal of SNA has been to develop metrics that help analysts gain a better understanding of a particular network's structural features. And although organizational theorists tend to explore such questions with the goal of identifying factors that will help strengthen organizations, those who study dark networks are generally more interested in identifying those aspects that will undermine them.

The remainder of this chapter introduces the basic terms, concepts, and assumptions of SNA as well as considers certain issues germane to this approach. It begins with a discussion of common misconceptions of what SNA is and how it differs from other analytic approaches. It then briefly discusses SNA's basic terms and concepts before moving to an extended exploration of the assumptions that underlie it. The chapter's final section considers the roles that human agency and culture play within SNA.

[3] Technically, in White's view meaning comes from switching between networks (Steiny 2007).

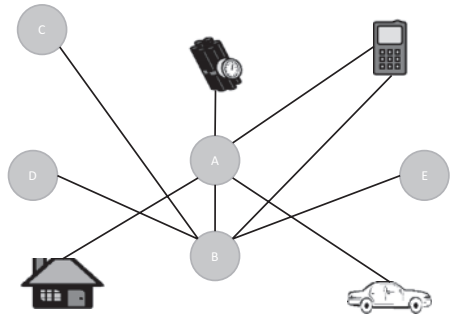

Figure 1.1. Illustrative Link Analysis Diagram

1.2 Misconceptions and Differences

SNA differs from other analytic methods and is often mistaken for other theoretical traditions. For example, the term *network* is used in different ways. Within some circles networks are seen as decentralized, informal, and/or organic types of organizations, and hierarchies are seen as centralized, formal, and/or bureaucratic types (Arquilla and Ronfeldt 2001; Burns and Stalker 1961; Podolny and Page 1998; Powell 1990; Powell and Smith-Doerr 1994; Ronfeldt and Arquilla 2001). This distinction is useful (and appropriate) in some theoretical contexts, but within the world of SNA all organizations are seen as networks. Some may be more hierarchical than others, but they are nevertheless networks (Nohria 1992). Indeed, algorithms have been developed that measure the degree to which a particular network is hierarchical (see, e.g., Davis 1979; de Nooy et al. 2005:205–212; Krackhardt 1994). This is not to say that there is a right or wrong way to use the term network. Rather, the term means different things in different contexts, and within SNA everything is considered a network.

SNA is also sometimes confused with link analysis, a related but distinct analytic approach that also examines the relational patterns of various objects. The basic difference between the two approaches is that although link analysis diagrams often include different types of objects (e.g., individuals, cars, cell phones) and the ties between them, social network diagrams only include ties between similar types of objects. Take, for example, a link analysis diagram where two individuals (A and B) each have links to five other objects, but the objects to which they have ties differ from one another (Figure 1.1). In this example, person A is linked to person B as well as a bomb, a cell phone, a house, and a car, whereas person B is linked to four individuals (A, C, D, and E) and a cell phone. Although both have five ties (which is the definition of *degree centrality* – see

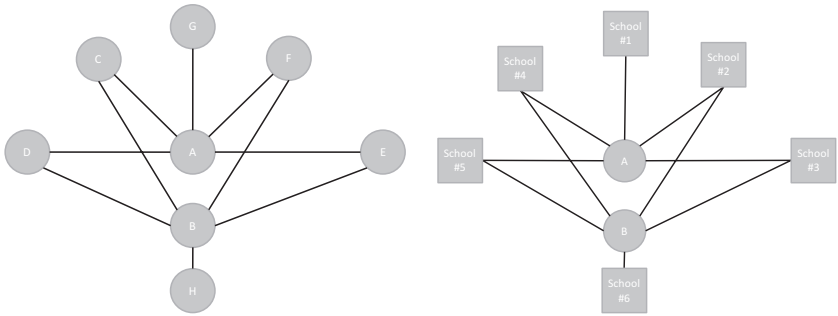

Figure 1.2. Illustrative SNA Diagrams

discussion in Section 7.1), we cannot meaningfully compare the number of ties of these two individuals because the ties are to different types of objects. It would be like comparing apples and oranges.

By contrast, in an SNA diagram actors have ties to similar objects, making direct comparison of numbers of ties meaningful. This is illustrated in Figure 1.2 where in the left panel individuals A and B each have five ties to five other individuals, and in the right panel they have five ties to five different schools. In both cases, A's ties are comparable to B's because they are to the same type of object. Of course, social network analysts are interested in more than the count of an actor's ties (although degree centrality is one of the oldest and most common metrics used by social network analysts), but other SNA algorithms generally assume that ties are between similar types of objects as well.

Finally, SNA differs from more traditional approaches (i.e., variable-based) in that although the latter focus on actors' attributes (e.g., gender, race, education) and ignore the broader social interaction patterns in which they are embedded (e.g., at home, work, and place of worship), SNA focuses on how these interaction patterns affect behavior, noting that although many attributes remain the same across social contexts, most interaction patterns do not, suggesting that interaction patterns are just as (or perhaps more) important for predicting and understanding behavior than are attributes:

> A woman who holds a menial job requiring little initiative in an office may be a dynamic leader of a neighborhood association and an assertive PTA participant. Such behavioral differences are difficult to reconcile with unchanging gender, age, and status attributes, but comprehensible on recognizing that people's structural relations can vary markedly across social contexts. (Knoke and Yang 2007:5)

SNA, then, is a collection of theories and techniques that provide empirical content to social context. It has been used successfully to explain

varieties of behavior because it forces researchers "to think in terms of constraints and options that are inherent in the way social relations are organized" (Raab and Milward 2003). For example, Padgett and Ansell (1993) found that whether or not certain elite families in fifteenth-century Florence supported the Medicis or one of their rival political factions depended more on the pattern of economic, patronage, and marital ties than on the various families' class and status attributes (Knoke and Yang 2007:5).

1.3 Basic Terms and Concepts

Actor

In SNA the term *actor* refers to discrete individuals, subgroups, organizations, collectivities, communities, nation-states, and so on that are involved in social relations. In other words, SNA does not always focus on individuals, a fact that is often ignored by analysts using SNA in their attempts to disrupt dark networks. Within SNA, actors are sometimes referred to as *nodes* and *vertices*.

Tie

Actors are linked together by *ties*. Ties can vary in terms of type, strength, and direction. Examples of types of ties include (adapted from Wasserman and Faust 1994:18):

- Ties of sentiment (friendship, liking, respect)
- Resource ties (business transactions, financial flows)
- Ties of association or affiliation (members of the same church, club, etc.)
- Behavioral ties (communication ties)
- Ties based on geographic movement (migration, physical mobility)
- Ties based on status movement (social mobility)
- Ties based on physical connection (road, river, or bridge connecting two points)
- Formal ties (organizational hierarchy)
- Biological ties (kinship)

Ties can be said to vary on a continuum from strong to weak (Granovetter 1973, 1974). At the individual level, we can think of strong ties as those where actors have repeated and relatively intense interactions with one another, whereas we can think of weak ties as those where actors see one another occasionally or rarely. Nevertheless, it is not always self-evident where the cutoff between a strong and weak tie exists (Krackhardt

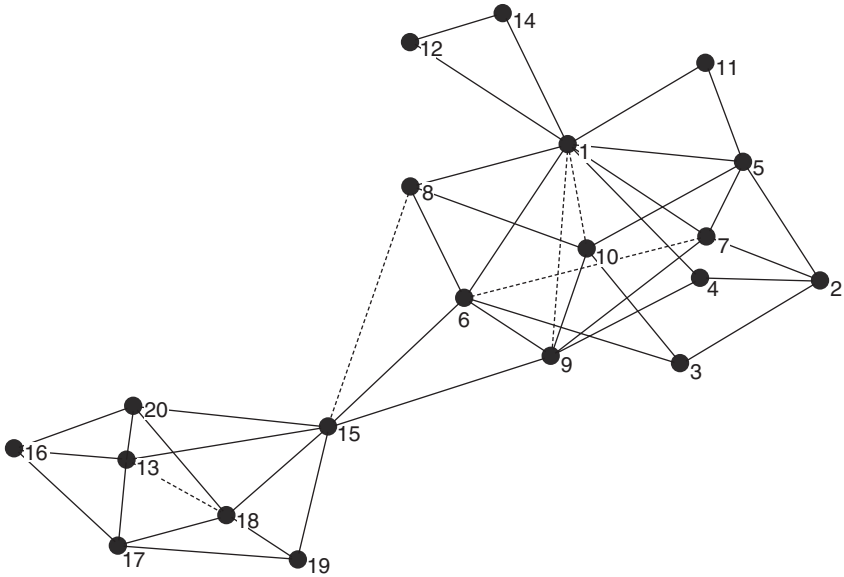

Figure 1.3. Hypothetical Social Network

1992). Moreover, what distinguishes a weak tie from the numerous, random, and usually unrepeated encounters actors experience daily is not always clear (Azarian 2005:37). Determining a threshold or cutoff value for identifying what constitutes a tie is (or at least should be) a difficult task. It is helpful to think of a social tie as "a theoretical construction, abstracted by the analyst from the bulk of largely erratic streams of affections, encounters, and interactions between a pair of actors, be they human beings, informal groups, formal organizations, or others" (Azarian 2005:37). A tie that has directionality (e.g., the flow of resources from one actor to another, where one actor communicates with another actor) is sometimes referred to as an arc. A tie that does not have directionality (e.g., spouse, kin) is sometimes referred to as an edge.

Social Network (and Social Network Analysis)

A social network is "a finite set or sets of actors" that share ties with one another (Wasserman and Faust 1994:20), and social network analysis involves "detecting and interpretating patterns of social ties among actors" (de Nooy et al. 2005:5). Figure 1.3 depicts a hypothetical social network where the circles represent actors and the lines (solid and broken) represent ties or relations. As this network illustrates, seldom are actors located randomly in networks; instead, they typically cluster within relatively distinct subgroups. Moreover, some actors are embedded deeply

within a subgroup, while others sit more on the periphery, sometimes serving as bridges between subgroups.

Path (and Path Distance)

Notions of *path* and *path distance* are probably easier to illustrate than define, so here we do both. A *path* is defined as a *walk* (i.e., a sequence of actors and ties) in which no actor between the first and last actor of the walk occurs more than once, whereas the *path distance* between two actors is the number of steps between the two actors (Wasserman and Faust 1994:107).[4] Looking at Figure 1.3 you can trace a path from actor 9 to actor 19 through actor 15, and a path from actor 6 to actor 11 through actor 1. In both cases the distance between the actors is two (i.e., two steps). It is quite common for there to be numerous paths between actors, with some paths longer and shorter than others. The shortest path between two actors is known as a *geodesic*.

Topography

Networks differ from one another in terms of their overall structure or *topography*, and evidence suggests that a network's topography has a strong impact on the behavior of its members and is related to its performance and/or efficiency. For example, researchers have found that network density is positively related to the likelihood that actors within the network will follow accepted norms and behavior, which is why a primary basis for moral order is highly connected social networks. Why? One reason is that in dense networks it is easier for people to monitor the behavior of others and prevent them from engaging in deviant behavior (Granovetter 1992, 2005). Another is that most people are more likely to conform to social norms when they run the risk of losing their relationships to others if they do not (Finke and Stark 2005), and in dense networks we are more likely to have ties (relationships) that we are unwilling to lose, whereas in sparse networks we often lack the social ties that would otherwise prevent us from misbehaving. Take frontier areas like the Wild West, for instance. People are constantly passing through, which makes it hard for social ties to form, so social networks tend to be sparse. Sparse networks also make it difficult for institutions

[4] When discussing traveling from one actor to another, social network analysts distinguish between three types of connections: walks, trails, and paths. A *walk* is a sequence of actors and ties that begins and ends with actors and can involve the same actor more than once. A *trail* is also a walk but a particular tie can only be traversed (i.e., used) once. Thus, while all trails are walks, not all walks are trails. Finally, a *path* is a walk where, with one exception, each actor and each tie can only be used once. The exception is that the beginning and ending actor can be the same. See Wasserman and Faust 1994:105–108.

(like churches) to form, which is why frontiers tend to be short on piety and long on deviance (Finke and Stark 2005).

Another phenomenon related to network density is what some call the law of group polarization (Sunstein 2003:111–144), which "predicts that when like-minded people deliberate as an organized group, the general opinion shifts toward extreme versions of their common beliefs. In a product-liability trial, for instance, if nine jurors believe the manufacturer is somewhat guilty and three believe it is entirely guilty, the latter will draw the former toward a larger award than the nine would allow on their own. Or, if people who object in varying degrees to the war in Iraq convene to debate methods of protest, all will emerge from the discussion more resolved against the war" (Bauerlein 2004:B8). Sageman's (2004) study of the global Salafi jihad (GSJ) uncovered similar group dynamics.[5] He found that people who joined the GSJ were often homesick young men who drifted to familiar settings, such as mosques, looking for companionship. There, small clusters of friends formed. They often moved into apartments together where they underwent a long period of intense social interaction in their apartments and developed strong mutual intimacy (i.e., formation of dense networks). As they became closer, they progressively adopted the beliefs of the group's most extreme members. This distanced them further from their childhood friends and family, leading to increased isolation and loyalty to the group, which in turn intensified their faith, and they were then ready to join the jihad.

A network's topography can vary along several dimensions, and there are a number of measures available to social network analysts:

- *Density* is probably the most common metric; it captures the interconnectedness of a network and is equal to the ratio of actual ties to possible ties. As we will see, however, its formal measure has its limitations, and this has led researchers to suggest the use of alternative measures.
- *Centralization* is perhaps the next most common and (as the name suggests) measures the extent to which a network is centralized around a few actors; like density it has its limitations, and it varies depending on which centrality measure is used.

[5] By global Salafi jihad, Sageman means those Muslims who believe that in order for Islam to recapture the economic, cultural, and military preeminence that it once enjoyed, not only do Muslims need to return to the practices of their devout ancestors (*salaf* in Arabic), but also that it is permissible to use violence against both the near enemy (Muslim states that have fallen away from the true faith) and the far enemy (the West, in particular the United States and Israel). When speaking of the global Salafi jihad, he generally is referring to terrorists who focus their efforts on the West.

- Another useful measure is *fragmentation*, which is the proportion of all pairs of actors that are not tied with one another.

Other topographical measures include *network size* (the number of actors in a network), *average distance* (the average length of the geodesics between all actors in a network), and *diameter* (the length of a network's longest geodesic). We consider these and other measures in depth in Chapter 5.

Cohesive Subgroups (Subnetworks)

A major focus of SNA is to identify dense clusters of actors "among whom there are relatively strong, direct, intense, and/or positive ties" (Wasserman and Faust 1994:249). Social network analysts often refer to these clusters of actors as *cohesive subgroups* or *subnetworks* and generally assume that "social interaction is the basis for solidarity, shared norms, identity, and collective behavior, so people who interact intensively are likely to consider themselves a social group" (de Nooy et al. 2005: 61). If we lived in an ideal world, there would be one method that analysts could use to identify cohesive subgroups, but since we do not, it should not be a surprise that social network analysts have developed a variety of methods for identifying clusters of actors (Scott 2000). Chapter 6 explores some of the various approaches for using patterns of ties for identifying cohesive subgroups within social networks.

Centrality

The notion that certain actors within a network are more central than others goes back at least as far as Jacob Moreno's (1953) conception of sociometric stars and isolates (de Nooy et al. 2005; Scott 2000). Alex Bavelas (1950) was the first to formally investigate the properties of centrality as he looked at how a network influences the flow of communication in experimental groups (Scott 2000). Most social networks contain people or organizations that are more central than others and because of this they enjoy better access to resources and are in better positions to spread information. Social network analysts have identified several measures of centrality, each based on different assumptions of what it means to be more central (these are discussed in further detail in Chapter 7). The most commonly used measures are degree, closeness, betweenness, and eigenvector:

- *Degree centrality* is the count of the number of an actor's ties.
- *Closeness centrality* measures (based on path distance) how close, on average, each actor is to all other actors in a network; as we

will see, there are some limitations to the traditional closeness measure, but alternative measures are available.

- *Betweenness centrality* measures the extent to which each actor lies on the shortest path between all other actors in a network.
- *Eigenvector centrality* assumes that ties to highly central actors are more important than ties to peripheral actors, so it weights an actor's summed ties to other actors by their centrality scores.

Brokers and Bridges

Bridges are ties that span gaps in a social network, whereas *brokers* are those actors who sit aside a bridge. Both can be seen as being in a position to control the flow of resources through a network. In terms of Figure 1.3, the edges between actor 15 and actors 6, 8, and 9 would all be considered bridges, while the four actors would be considered brokers. That said, because actor 15 sits aside all three bridges, whereas the other three actors sit aside only one, actor 15 is clearly in more of a position of brokerage than are 6, 8, and 9. In other words, brokerage potential is not something that actors have or don't have, but rather is more a matter of degree. The same can be said of bridges. As we will see in our analysis of brokers and bridges in Chapter 8, some bridges are more crucial than are others.

Roles and Positions

Social network analysts typically analyze network data in one of two ways: (1) a relational, or (2) a positional approach (Emirbayer and Goodwin 1994). The former focuses on the direct and indirect ties between actors and seeks to explain behavior and social processes in light of those ties (Emirbayer and Goodwin 1994:1419). It highlights the importance of the topography of networks, the centrality of actors, the cohesiveness of subgroups, and the brokers and bridges between such groups. By contrast, the positional approach differs in that rather than focusing on the ties between actors, it seeks to identify structurally equivalent actors, that is, actors who may or may not have ties to one another but hold a similar position within a particular social network (e.g., the chief surgeons of different hospitals, the chairs of sociology departments in different academic institutions, the detachment commanders of a special forces operational detachment). It assumes (among other things) that structurally equivalent actors are likely to behave in similar ways regardless of whether a tie exists between them or not. Structurally equivalent positions can be observed by looking at the actors to whom a particular actor is connected (e.g., a chief surgeon interacts with surgical nurses and other surgeons; the chair of a sociology department interacts with graduate students,

other professors, chairs of other departments, and university administrators; a detachment commander interacts with other officers and those under his or her command). "The relevant issue from this point of view is the specific 'position' or 'role' that a set of actors occupies within the system as a whole. Any such set is termed a 'block'" (Emirbayer and Goodwin 1994:1422), and the process by which such blocks are identified is referred to as *blockmodeling* (White, Boorman, and Breiger 1976). Analysts have developed a number of different types of algorithms for identifying structural equivalent actors (e.g., structural equivalence, automorphic equivalence, regular equivalence) and multiple algorithms within each of these types. We consider blockmodeling in Chapter 9.

Attributes

While SNA focuses primarily on the pattern of ties between actors, most social network analysts do not completely ignore attribute data (although some do – see the discussion of social networks, human agency, and culture in Section 1.5), which are characteristics of individual actors. If the actors in a network are individuals, then attribute data include things such as gender, race, ethnicity, years of education, income level, age, and so on. If the actors are corporations, then attribute variables can be those that measure total sales, net income, age of the corporation, number of employees, and so on. And if the actors are countries, then attribute variables would include measures such as GDP per capita or population size. As we will see later, centrality measures (once calculated) become attributes of actors as well. Sometimes the boundary between attributes and affiliations can be somewhat fuzzy. As a general rule, something is an affiliation if two actors' participation in that affiliation indicates a relationship, but it is also possible for an affiliation to function as an attribute as well.

1.4 Assumptions

While some have noted that SNA is more a collection of methods than a coherent theory (see, e.g., Granovetter 1979), most SNA methods are built on a common set of assumptions (Azarian 2005; Christakis and Fowler 2009; Knoke and Yang 2007; Wasserman and Faust 1994):

- Actors and their related actions are interdependent, rather than independent, with other actors.
- Ties between actors are conduits for the transfer or flow of various types of material and/or nonmaterial goods or resources (e.g., funds, supplies, information, trust, enmity).

- Social structures are seen in terms of enduring patterns of ties between actors (i.e., social networks).
- Repeated interactions between actors give rise to social formations that take on a life of their own, follow their own logic, and cannot be reduced to their constituent parts even though they remain dependent on those parts.
- An actor's position in the social structure (i.e., its structural location) impacts its beliefs, norms, and observed behavior.
- Social networks are dynamic entities that change as actors, subgroups, and ties between actors enter, form, leave, or are removed from the network.

Each of these assumptions is discussed in turn and illustrated with examples from various studies not only to make them more intelligible but also to draw out possible implications for applying SNA to the study of dark networks.[6]

Interdependence of Actors

SNA assumes that actors do not make decisions as autonomous units but instead are strongly influenced by the behavior and choices of other actors. At the individual level this can be illustrated by Solomon Asch's (1955) conformity experiments and Stanley Milgram's (1974) obedience to authority experiments.

Solomon Asch: Social Conformity. In his social conformity experiment, Solomon Asch sorted college students into groups of eight to ten subjects and told them that they were participating in a study about visual perception. The experiment entailed eighteen trials in which two cards, similar to those in Figure 1.4, were projected on a screen. Asch instructed the students that they were to choose the bar on the right card that was the same length as the bar on the left card. Moreover, they were to state their answers out loud so that all the other participants could hear their answer.

Of course, the experiment was rigged. Only one of the students was a real subject – the rest were Asch's confederates, who gave incorrect answers on twelve of the eighteen trials. Asch made sure that the real subjects were next-to-last to announce their answers so that they would hear most of the confederates' incorrect responses before they gave their own. He was curious to see whether the subjects would feel any pressure

[6] One could argue that some of these assumptions can be derived from others and thus should not be considered an assumption. For instance, the third assumption can be derived from the fourth, and the fifth can be derived from the first and third. Nevertheless, in getting at the essence of SNA, it is easier to simply list and discuss them separately.

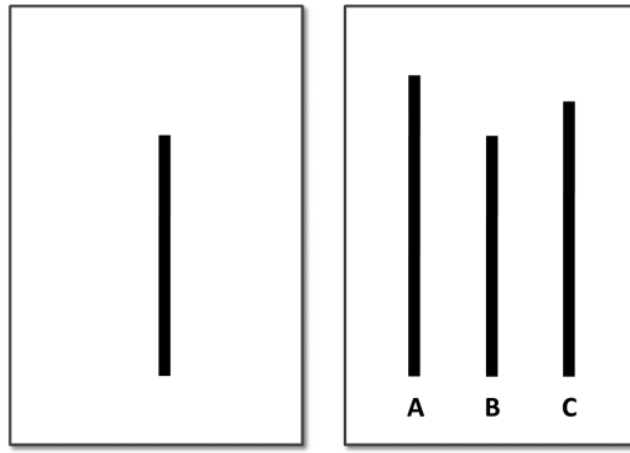

Figure 1.4. Solomon Asch's Conformity Experiment

to give the same answers as the confederate majority, even when the latter clearly answered incorrectly. Asch found that thirty-seven of the fifty subjects conformed to the majority at least once, while fourteen conformed on more than six of the twelve trials. The average conformity rate was one-third (four out of twelve trials). Asch varied the number of confederates from one to fifteen and found that subjects conformed to a group of three or four as readily as they did to larger groups. He did discover, however, that subjects were less likely to conform if they had an ally. If one of Asch's confederates gave the correct answer, subjects conformed only one-fourth as often as they did in the original experiment.

Stanley Milgram: Obedience to Authority. Subjects who participated in Stanley Milgram's "Obedience to Authority" experiments were told that the experiment was designed to test the effect of punishment on learning. Upon arriving they were sorted into "teachers" and "learners" by the drawing of slips. Unbeknownst to them, the drawing of slips was set up in such a way that the true subjects always ended up as teachers and Milgram's confederates always ended up as learners. Milgram (or one of his experimenters) told the teachers (i.e., the subjects) that their job was to teach a series of word pairs to the learners; their specific task was to administer a shock to the learners each time they made a mistake recalling a word. The teachers watched as the learners were strapped into an electric chair with an electrode taped to their wrist that the teachers were told was attached to a shock generator. The teachers were then taken to an adjacent room and seated in front of the shock generator. The generator had thirty switches, indicating the number of volts that could be administered, ranging from 15 to 450 volts, accompanied by

labels ranging from "Slight Shock" to "Very Strong Shock" to "Danger: Severe Shock" to "XXX" (evidently indicating a lethal level of shock). The experimenter then told the teachers that they were to increase the shock level by 15 volts each time the learners gave a wrong answer.

The learners (i.e., the confederates) did not really receive any shocks, but the teachers (i.e., the subjects) did not know this. Initially, the learners only voiced verbal protests about the painfulness of the shocks, but once the shock level reached 300 volts, they began pounding the wall and, from that point on, did not answer. Eventually, they even stopped pounding. Throughout the experiment, the experimenter would restate the teachers' duties. If the teachers looked to the experimenter for guidance, the experimenter would say, "Please continue." If they protested that the learners were not answering, the experimenter would state that the learners' failure to answer should be treated as a wrong answer. If the teachers expressed reluctance to continue or suggested that the learners' condition should be checked, the experimenter would insist that "the experiment requires that you continue." If the teachers became really insistent, the experimenter would say, "You have no choice; you must go on."

In the end, every single teacher (i.e., subject) went beyond the 300-volt level and more than half – 65 percent – obeyed to the 450-volt end. These results shocked a great number of people, and not just those involved in the experiment. Up until this point many people believed that the Holocaust was a product of German culture or psyche, but these experiments suggested that in certain social contexts, ordinary individuals could do horrible things to their fellow human beings (Saltzman 2000). This is especially true when people are asked to obey people they perceive to be authorities or experts in their field (Sunstein 2003:35). Interestingly, in a variation on the experiment where it was conducted at an office in a rundown commercial building, only 47.5 percent of the subjects obeyed to the end (Milgram 1974:66–70), highlighting the important role that social context can play in human behavior.

Implications. These studies and others (Zimbardo, Maslasch, and Haney 2000) suggest that far from acting independently of those around them, people do just the opposite. In the face of peer pressure, Asch's student subjects chose to go along with the crowd even when the correct answer was obvious. How much more likely are people to go along with the crowd when they are presented with much more ambiguous information? Milgram's subjects demonstrate how perceived expertise or authority can lead people to make choices that one would hope they would otherwise not make. How are we to effectively combat the global Salafi jihad (Sageman 2003, 2004) when members of terrorist networks look to "respected" authorities such as Osama bin Laden and Ayman al-Zawahiri

for inspiration (even after they are no longer living)? Put simply, these studies suggest that when analyzing the behavior of actors, if we do not take into account the social context in which they are embedded, we could arrive at a serious misunderstanding of their actions.

Following the crowd is not limited to individuals. As Paul DiMaggio, John Meyer, and Woody Powell (and their numerous colleagues) have repeatedly pointed out (see, e.g., DiMaggio and Powell 1983; Frank, Hironaka, and Schofer 2000; Meyer et al. 1997; Meyer and Rowan 1977; Powell and DiMaggio 1991), groups, corporations, and nation-states are no more likely to act autonomously than are individuals. For example, organizations that interact with one another tend to become more like one another over time. This tendency is not driven primarily by concerns over the bottom line, but rather by the concern that these organizations maintain their legitimacy in the eyes of other similar organizations (DiMaggio and Powell 1983).

> When an organizational practice or structure becomes commonly understood as a defining feature of a "legitimate" organization of a certain type, organizational elites feel pressure to institute that practice or structure. If there is a cultural norm that says, "In order for an organization to be a good organization, it must have characteristic X," organizations feel pressure to institute characteristic X. (Chaves 1997:32–33)

Ties as Conduits

Another SNA assumption is that ties (i.e., relations) between actors can function as conduits for the diffusion of various types of material and nonmaterial "goods," such as information, feelings, financial resources, norms, diseases, opinions, and trust. The Columbia University Drug Study, which documented the adoption by medical doctors of a new drug (Coleman, Katz, and Menzel 1957), illustrates this. Researchers gained access to local pharmacy prescription records and recorded when physicians first prescribed the drug. They also collected friendship and communication ties between the doctors, asking each to name three doctors whom they considered to be personal friends and three doctors with whom they would discuss medical matters. What they found was that the use of the new drug diffused quicker through social ties than apart from them. Subsequent studies found that other factors were important (Burt 1987), but they still affirmed the channeling effect of social ties (Strang and Tuma 1993).

The Strength of Weak Ties. Perhaps the best-known example of how ties can function as conduits for information is Mark Granovetter's (1973,

1974) study of how people got their present jobs. He found that they were far more likely to have used occasional personal contacts in finding their present job than by other means, suggesting that a particular type of tie, what he called "weak ties," plays an important role in the diffusion of information, such as job information. Granovetter collected data on how people found their current jobs and although approximately 19 percent used formal means[7] and another 19 percent directly applied for their job,[8] approximately 56 percent found their jobs through personal ties, of which most were weak ties (i.e., acquaintances, not close friends). Only 16.7 percent said that they saw their contact regularly at the time they heard about the job, while 55.6 percent said they saw their contact occasionally, and 27.8 percent said rarely (Granovetter 1973:1371). Moreover, workers who were not job hunting when they found their present jobs were more likely to have heard about them through weak ties.

All this led Granovetter to argue that when it comes to finding jobs, our weak ties – that is, our acquaintances – are more useful than our strong ties. Why? Because our acquaintances (i.e., our weak ties) are less likely to be socially involved with one another than are our close friends (i.e., our strong ties). Imagine the pattern of social ties suggested by this argument (Figure 1.5) and take any individual in the network. He or she will most likely have a collection of close friends, most of whom know one another. This same individual will also probably have a collection of acquaintances, few of whom know one another. But these acquaintances, in turn, are likely to be embedded in tightly knit networks of their own although different from our original individual. According to Granovetter, weak ties are important in terms of the overall structure of a network because they form the crucial bridges that tie these densely knit clusters of people together. In fact, if it were not for these weak ties, these clusters would not be connected at all.

Granovetter (1973:1363) also concluded that while not all weak ties are bridges, all bridges are weak ties. This is because of a process captured by what he referred to as the forbidden triad (Figure 1.6). Imagine that the ties between A and B and A and C are strong, and that initially B and C have no relationship with one another. In the short run the strong ties that run from C to B through A will function as a bridge between C and B. However, in the long run a tie will form between C and B (this is known as triadic closure) because A regularly interacts with B and C and odds

[7] Formal means is where the job seekers used the services of impersonal intermediaries such as advertisements, public and private employment agencies, interviews, and placements sponsored by universities or professional associations.

[8] Direct application is where the job seekers went or wrote directly to a firm, did not use a formal or personal intermediary, and had not heard about a specific opening from a personal contact.

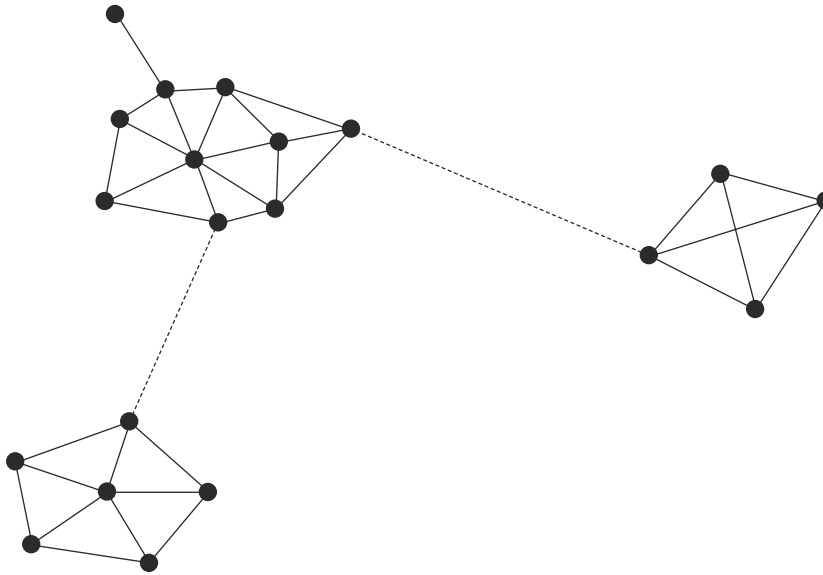

Figure 1.5. Strong and Weak Ties

are that in the long run B and C will meet and a tie will form between them. The resulting tie may be strong or weak, but the end result is that the ties running between C and B through A will no longer function as a bridge between C and B. Put differently, our close friends' close friends are likely to at least become acquaintances and possibly even friends (Rapoport 1953a, b; Rapoport and Horvath 1961). While Granovetter conceded that his argument was something of an exaggeration, he noted that research suggests that it holds true most of the time (Holland and

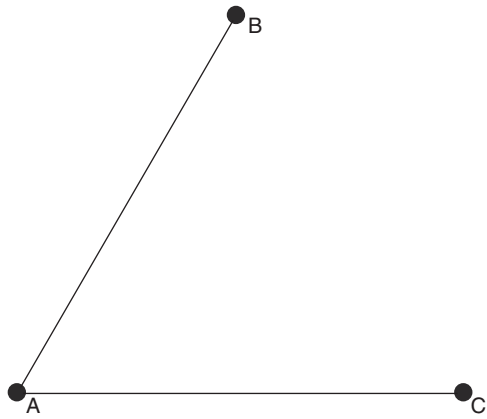

Figure 1.6. Granovetter's Forbidden Triad

Leinhardt 1971, 1972), meaning that weak ties are much more likely to form bridges than are strong ties (Onnela et al. 2007).

Granovetter's argument suggests that whatever good is to be diffused – whether it is job information, influence, resources, or trust – it will reach more people and travel a greater social distance if it passes through weak rather than strong ties (Granovetter 1973:1366). It also implies that actors with few weak ties are more likely to 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" (Granovetter 1983:202). Their lack of weak ties "will not only insulate them from the latest ideas and fashions, but it may also put them at a disadvantage in the labor market, where . . . knowing about appropriate job openings at just the right time" is paramount (Granovetter 1983:202).

Implications. Does this have any other implications for dark networks? Yes. In his analysis of the March 11, 2004, Madrid bombings, Rodriguez (2005) concludes that weak ties were a key feature of the terrorist network in that they enabled its cells to maintain operative ties with the larger network from which they were able to draw material supplies and ideological support. Rodriguez also believes that weak ties provide benefits to dark networks in other ways. He argues, for instance, that weak ties provide them with (1) relative stability when members are arrested or missions fail, (2) more flexibility that allows them to rapidly adapt to a changing environment, and (3) higher levels of security because weak ties are harder to detect than strong ones.

This is not to argue that strong ties are of no value. Indeed, "there is a mountain of research showing that people with strong ties are happier and even healthier because in such networks members provide one another with strong emotional and material support in times of grief or trouble and someone with whom to share life's joys and triumphs" (Stark 2007:37). Thus, feelings of trust and solidarity are more likely to be shared across strong ties than weak ones. This suggests that in order for dark networks to operate effectively they require an optimal mix, or what Aristotle called the "golden mean," of weak and strong ties. It also suggests that if we want to disrupt a dark network, altering this mix may prove to be a viable strategy. We will return to this topic in Chapter 5.

Social Structure in Terms of Social Networks

Social scientists frequently refer to the concept of *social structure*. By this term they usually have in mind the enduring patterns of behavior and relationships within social systems (e.g., roles) or the social institutions and norms that have become embedded in social systems in such a

way that they shape behavior (Wikipedia 2007). Take, for example, this passage from an introductory sociology textbook:

> If you stand on the sidelines and watch the world pass you by, what you see is people moving about and somehow avoiding each other, people talking, people going in and out of buildings, people sitting on benches, people driving cars, people congregating, and in general you see just a maze of activity as individuals move about in physical space. There is fluidity to social life when examined this way, but there is also order, at least most of the time. People are not randomly moving about, talking, driving, entering and exiting buildings, or sitting around; they have purposes and goals as they move in space and talk to each other. But there is more than just purpose; there is structure to what you see as you look at the ebb and flow of human activity. Part of this structure inheres in the organization of symbols into culture, as it directs and guides individuals to act in certain ways. But for culture to be really effective in regulating conduct, it must be attached to something that orders social life. This extra "something" is social structure. *Social structures constrain who is present, where they stand, what they can do, and how they are related to each other. This structure is as real as the buildings that people occupy*. (Turner 2006:88, emphasis added)

However, while social structure may be as real as the buildings that people occupy, it is notoriously difficult to measure. It is easy to talk about social structure in the abstract but much harder to quantify. Within SNA social structures are seen in terms of enduring patterns of ties between actors (i.e., social networks). Thus, what SNA does is provide a method for systematically and empirically studying the causes and consequences of social structure (Degenne and Forsé 1999). It is an approach designed to explore and empirically capture the patterns of ties between people, groups of people, organizations, and countries.

Emergent Social Formations

Implicit but often unstated in the previous assumption is the belief that repeated interactions between actors (e.g., individuals) can give rise to social formations (e.g., groups, formal organizations) that take on a life of their own, follow their own logic, and cannot be reduced to or explained by their constituent parts even though they remain dependent on those parts (Clayton and Davies 2006; White 2008). While this may seem like an extraordinary claim, examples of emergence are quite common in

the physical world, such as the combination of hydrogen (H) and oxygen (O) into water (H_2O):

> Water cannot exist apart from the hydrogen and oxygen that compose it . . . However, in their combination, the hydrogen and oxygen give rise to a truly new thing that is quite unlike either H or O, whether taken alone or as a sum of the separate parts H and O. Water, for example, has the characteristic of wetness, while hydrogen and oxygen do not. Water, furthermore, has the capacity to extinguish fires, while H and O feed fires. Water is the emergent reality brought about by a particular combination of hydrogen and oxygen. Water is very real and unique in its existence. It is composed of definite substances. But it is irreducible to that of which it is composed. Literally and truly something new has come into existence that is more than the sum of its parts. (Smith 2010:27)

Much like water cannot be reduced to or explained entirely by its underlying atoms but is still dependent on them, emergent social formations such as groups and organizations are products of interactions between actors that cannot be entirely explained by looking solely at the characteristics of those actors. Instead, they take on a life of their own and follow their own logic, which means that actors of all types and levels – whether they are individuals, groups, organizations, or nations – can be examined using SNA without needing to reduce them to the lower-level actors of which they are comprised.[9] For example, we can examine the social networks of Sudanese tribes (Colloton, Maitre, and Stoner 2007) and social movement organizations (Osa 2003) apart from the individuals who populate such tribes and organizations.

Implications. As we will see in the next chapter, this has important implications for the crafting of strategies because it means that SNA can be used for analyzing dark networks at the micro (e.g., individual), meso (e.g., group), and macro (e.g., institutional) levels. One last aspect of emergence worth noting is that emergent social formations can exert what is referred to as *downward causation* on lower-level entities, by which is meant that the former influences the actions of the latter. This fact serves as a nice segue to the next assumption of SNA: namely, the idea that an actor's structural location profoundly impacts its beliefs, behavior, and identity.

[9] It is important to note that the language of lower and higher does not imply an evaluative judgment of better or worse (Smith 2010:33).

Structural Location: Beliefs, Norms, Intentions, Behavior, and Identity

SNA assumes that actors' attitudes, beliefs, intentions, behavior, and even their identities are largely determined by their location in the social structure. Such an assumption is at odds with what many moderns believe to be true:

> Humans come to believe in a world full of continuous, neatly bounded, self-propelling individuals whose intentions interact with accidents and natural limits to produce all of social life . . . Closely observed, however, these same humans turn out to be interacting repeatedly with others, renegotiating who they are, adjusting the boundaries they occupy, modifying their actions in rapid response to other peoples' reactions, selecting among and altering available scripts, improvising new forms of joint action, speaking sentences no one has ever uttered before, yet responding predictably to their locations within webs of social relations they themselves cannot map in detail . . . They actually live in deeply relational worlds. (McAdam, Tarrow, and Tilly 2001:131)

The impact of social structure on actor behavior can be illustrated by examining what social scientists have learned about the process of conversion (recruitment) to religious and social movements. These studies show that people who are structurally (i.e., socially) close to a particular movement, religious or otherwise, are much more likely to join that movement than are those who are not.[10]

Conversion and Recruitment: Moonies, Mormons, and Movements. For years deprivation theory was the reigning theory of conversion. It argued that people join particular groups because they suffer from some sort of deprivation that the group's ideology (or theology) addresses. Thus, religious groups were seen as meeting particular needs – whether they were economic, social, or political. Consequently, researchers would look at a group's ideology to see what kinds of deprivation it addressed, and then conclude that people who joined that group must have been suffering from that sort of deprivation. For instance, because Christian Science promises to restore health, social scientists might conclude that Christian Science draws disproportionately from people suffering from chronic health problems or hypochondria (Glock 1964, cited in Stark 1996a:15). Of course, you could also argue the opposite that only people with good health would join and stay with a faith that believes that illness is only a

[10] To be clear, this is not the only way that the behavior of actors is affected by their structural location. It is just one among many.

state of the mind (Stark 1996a:15). Although it makes perfect sense that some people will find a particular ideology or theology more appealing than others, this does not explain why only some of these ideologically or theologically suited people actually join. That is where social network theory comes in. The basic insight of social network theory is that people will choose one religious group over another (or none at all) based on their patterns of ties. People are much more likely to join groups where they know people than where they do not.

Take, for instance, John Lofland and Rodney Stark's (1965; see also, Stark 1996a:13–21) study of people converting to the Unification Church, more commonly known as the Moonies. A woman named Young Oon Kim, who had come to California from Korea where she had been a university professor, started the local Moonies group. When she first arrived, she spoke at a number of public events, but these did not yield a single convert. Instead, her first three converts were close friends of hers whom she first got to know after she became a lodger with one of them. Next, some of the friends' husbands joined, and these were then followed by friends from work. The next converts were old friends, relatives, or people who first formed close friendships with one or more members in the group. As Stark notes, when he and Lofland first began watching the group, it "had never succeeded in attracting a stranger" (Stark 1996a:16). Moreover, Stark and Lofland witnessed a number of people who were sympathetic with the group's doctrines, but in the end did not join because they had numerous ties with people who disapproved of the Moonies. This led them to conclude that the people who ultimately joined the Moonies tended to be those whose ties to group members exceeded their ties to nonmembers (Stark 1996a:16).

In another study, Rodney Stark and Bill Bainbridge (1980) looked at the role that social ties play in recruiting people to the Mormon Church. Mormons tend to keep very good records of their missionary efforts and which methods work better than others, and Stark and Bainbridge were provided with data for all missionaries in the state of Washington during 1976–1977 (Stark and Bainbridge 1980:1386). Mormons recruit through a variety of means: They go door to door, they follow up on referrals, and they meet potential recruits in the home of a relative or friend of the potential recruits. Interestingly, when missionaries went door to door, their success rate was only 0.1 percent. Referrals provided a somewhat higher rate of success (7 percent for covert referrals and 8 percent for overt referrals). Their highest rates of success, however, occurred when Mormons invited non-Mormon friends and relatives into their homes to meet Mormon missionaries. In those instances, they enjoyed a success rate close to 50 percent. This suggests that the best strategy for conversion is not cold-calling but forming friendships with non-Mormons.

Stark and Bainbridge noted that an article in the Mormon Church's official magazine provided detailed instructions on how to recruit new members, and a recurring theme was the importance of building close personal ties with non-Mormons. It also explicitly instructed its readers that they should downplay or avoid discussing religion while forming these ties. Only later were they to bring up that they were Mormons (Stark 2005:79–80). "Another way of looking at these findings is that missionaries do not serve as the primary instrument of recruitment to the Mormon faith. Instead, recruitment is accomplished primarily by the rank and file of the church as they construct intimate interpersonal ties with non-Mormons and thus link them into a group network" (Stark and Bainbridge 1980:1387–1388).

Shortly after the Stark and Bainbridge study appeared, a study by David Snow and his colleagues (Snow, Zurcher, and Ekland-Olson 1980) highlighted essentially the same dynamic: Successful social movements, religious or otherwise, recruit primarily through social networks of friends and families. All of the groups they studied, except the Hare Krishna, recruited more than 50 percent of their members through either kinship or friendship networks with several recruiting more than 90 percent of their members through such networks. The lone exception was the Hare Krishnas. Why? Because the Hare Krishnas demand exclusive participation from their members and require them to sever all extramovement ties. Thus, they have no social networks outside of the group through which they can recruit, and this forces them to recruit from public places. That is why they are so small. Successful social movements must maintain open social networks in order to grow.

Implications. What these studies tell us is that people do not join groups randomly. Instead, individuals who are located socially proximate to a group are far more likely to join that group than are those who are socially distant. Put differently, the structural location of actors is a large factor in determining which groups they will join and which ones they will not. That is why it is not surprising that Sageman (2003, 2004) discovered that recruitment to the GSJ occurs primarily through social ties. He found that 65 percent of the terrorist group's members had preexisting friendship ties with someone in the group, whereas another 15 percent had kinship ties. After eliminating overlaps between the two types of ties, 75 percent of the terrorists Sageman studied joined through friendship and kinship ties. He found that another 8 percent had ties to teachers who had links to the jihad, meaning that 83 percent of the individuals who joined the GSJ joined through some sort of social ties. This led him to conclude that although factors such as anger at U.S. policies may increase the pool of potential recruits to the GSJ, only those who have a link to the group actually join.

Dynamic Social Networks

Finally, SNA assumes that networks are always changing as actors enter and leave the network and as ties form and dissolve. For example, the removal of key actors can disrupt the flow of information through the network, whereas the departure of a network's peripheral players could lead the network to become more isolated. Similarly, an actor's entrance into a network could temporarily destabilize the network as new lines of communication and trust are negotiated among network members. What this means in practical terms is that network structures are constantly in flux. Over time they become more or less fragmented, more or less dense, as well as grow or shrink in size. Additionally, groups of actors that cluster together at one point in time and that were central today may become less so next week (and vice versa). To make matters even more complicated, actors often move from one geographic location to another, which can potentially affect the impact they have on their network's operations. For example, if a dark network's one and only bomb maker is forced to move hundreds of miles away from where it carries out its operations, then the network's efficiency will almost certainly suffer.

Although social network analysts have always known this, historically, longitudinal network data have been difficult to come by and methods for their analysis were undeveloped. Indeed, Stanley Wasserman and Katherine Faust's classic SNA text makes little mention of longitudinal networks. Only in the book's final chapter does it note the importance of developing good and easy-to-use methods for examining longitudinal network data (Wasserman and Faust 1994:730–731).

This situation is beginning to change. Longitudinal network data and their analysis are becoming more common. Much of this analysis is largely descriptive in nature, but the development of model-based approaches are allowing analysts to uncover the underlying processes that may be at work in particular networks (Breiger, Carley, and Pattison 2003; de Nooy 2011; Doreian and Stockman 1997; McCulloh and Carley 2011; Snijders 2005; Snijders, Bunt, and Steglich 2010; Steglich, Snijders, and Pearson 2010). As appealing and promising as these models are, however, as of yet most do not fall into Wasserman and Faust's "easy-to-use" category, and their implementation often requires specialized software. Moreover, a lot can be said for techniques that allow analysts to track changes in a network's topographical characteristics, the degree of clustering among its members, and the emergence and decline of various actors. These more descriptive approaches can also be used to test hypotheses and are capable of uncovering many of a network's underlying dynamics (see, e.g., de Nooy et al. 2005:84–96). Although this book relies primarily on more descriptive approaches, it does explore some of the newer models, such as those that seek to detect significant changes in a network's structure,

those that take into account the geographic location of actors, and those that allow researchers to sort between genuine and spurious correlations.

Implications. All this suggests that not only do researchers need to closely monitor changes in dark networks but also that careful analyses will often suggest ways to disrupt or destabilize them. For example, Marc Sageman (2003, 2004) drew on the work of Albert-László Barabási and his colleagues (Barabási 2002; Barabási and Albert 1999; Barabási, Albert, and Jeong 1999; Barabási and Bonabeau 2003) to offer suggestions as to how to disrupt the GSJ. According to Barabási, the world is "small" because it exhibits the characteristics of a "scale-free network," which is a network where a handful of actors have many connections (i.e., hubs), but most actors have very few. Because most actors in a scale-free network have very few ties, scale-free networks are relatively immune to random failures but are vulnerable to targeted attacks. Research suggests that the removal of 10 to 15 percent of the hubs in a scale-free network will generally disconnect the network (Barabási 2002; Barabási and Bonabeau 2003). In his research, Sageman discovered that the GSJ also exhibits the characteristics of a scale-free network, which led him to argue that the United States should focus its efforts on destroying hubs rather than randomly stopping terrorists at its borders. "[The latter] may stop terrorists from coming here, but will leave the network undisturbed. However . . . if the hubs are destroyed, the system breaks down into isolated nodes. The jihad will be incapable of mounting sophisticated large scale operations like the 9/11 attacks and be reduced to small attacks by singletons" (Sageman 2003). To be sure, the simultaneous removal of 10 to 15 percent of a dark network's hubs is easier said than done, and research suggests that hubs are often quickly replaced by other highly central and/or structurally equivalent actors (Pedahzur and Perliger 2006; Tsvetovat and Carley 2005). Nevertheless, Sageman's approach illustrates how the removal of a few key nodes could significantly alter the dynamics of a dark network.

More recently, Ian McCulloh and Kathleen Carley (2011) applied social network change detection (SNCD) techniques to a number of longitudinal networks, including the Al Qaeda communication network from 1988 to 2004 (Carley 2006). SNCD is an analytic method for monitoring social networks that alerts analysts whether and when statistically significant changes have occurred in a network (either at the topographical or actor level), which allows them to potentially detect causes for the change and predict significant events or behaviors (McCulloh and Carley 2011:6, 10). For example, using SNCD to analyze yearly snapshots of the Al Qaeda communication network in terms of three social network measures – density, average closeness centrality, and average betweenness centrality – McCulloh and Carley detected that a statistically significant

change occurred in the network in 1997, which they then traced back to a series of events that helped unite Islamic militants and organize Al Qaeda for terrorist attacks aimed at the United States (McCulloh and Carley 2011:21). One can only wonder what might have been if these data and techniques had been available prior to September 2001.

1.5 Social Networks, Human Agency, and Culture

The priority that SNA places on relations between actors over individual attributes in explaining behavior and processes inevitably leads to questions of human agency and culture. Put simply, does SNA leave room for free will and the effects of culture? The answer is yes and no. Some versions of it do; some don't. Mustafa Emirbayer and Jeff Goodwin (1994:1424–1436) identified three social network paradigms to which most social network analysts adhere: structural determinism, structural instrumentalism, and structural constructionism. According to Emirbayer and Goodwin, *structural determinism* leaves no room for human agency or culture. It entirely ignores (or dismisses) the possible causal role that actors' beliefs, values, and commitments play in terms of social processes and historical change. The early writings of Harrison White (Boorman and White 1976; White, Boorman, and Breiger 1976) reflect this view as do those of the early network theorist, Bruce Mayhew:

> Structuralists do not attribute social or psychological characteristics to individual humans. Rather, structuralists view individual human beings as biological organisms. Hence, individual characteristics might include pulse rate, blood pressure, height, metabolic rate, and so on. But there are no social characteristics of individuals. To structuralists, social phenomena are properties of social networks (properties of organizations); they are never characteristics of biological individuals. Furthermore, for structuralists, psychological phenomena do not exist (they are not defined). (Mayhew 1980:346)

For Mayhew, individuals are no more than biological machines and human consciousness is irrelevant to understanding the social world (Smith 2010:242). Free will, in other words, does not exist in Mayhew's world.

By contrast *structural instrumentalism* does allow room for human agency, but social network analysts who adopt this approach tend to view it solely in terms of rational choice, instrumental action, and utility maximization. "Many, if not most, such network analysts assume unproblematically that actors – individuals and even groups or organizations – are utility maximizers who pursue their material interests in

money, status, and power in precisely the ways predicted by theorists of rational choice" (Emirbayer and Goodwin 1994:1428). Roger Gould's masterful network analyses of the Paris Commune (1991, 1993b) are examples of this because they assume that instrumental motivation lies behind the political mobilization they attempt to explain. The numerous studies of religious phenomena by Rodney Stark and his colleagues (see, e.g., Lofland and Stark 1965; Stark 1991, 1996a, b; Stark and Bainbridge 1980) fit into this paradigm as well. Given that ample evidence exists supporting the premise that actors do respond to incentives (see, e.g., Becker 1976; Berman 2009; Iannaccone 1995; Levitt and Dubner 2005), this approach clearly improves on the previous one. As Granovetter puts it, "while the assumption of rational action must always be problematic, it is a good working hypothesis that should not easily be abandoned" (Granovetter 1985:506). Nevertheless, as the structural constructionist approach discussed in the following paragraph highlights, it is not without its shortcomings.

Structural constructionism, like structural instrumentalism, takes seriously the role of human agency in attempting to account for social change, but unlike structural instrumentalism, it sees actors as motivated by additional concerns, such as norms, values, cultural commitments, and collective and individual identities. In short, adherents to this perspective hold that culture plays a role as well. Emirbayer and Goodwin hold up Doug McAdam's (1986, 1988a) analysis of Freedom Summer as an example of this approach (see also McAdam et al. 2001), whereas Christian Smith (2010) points to David Knoke, who argues that

> a sophisticated understanding of . . . action requires blending cultural, rational, and structural constraints in complex specifications for given substantive problems. The structural perspective should be seen as an enriching, rather than a competing, paradigm. (Knoke 1990:19, quoted in Smith 2010:228)

The later writings of Harrison White (1992, 2008), with his emphasis on the importance of narratives, stories, and networks of meaning, can also be located here.

While the methodologies detailed in this book tend to be agnostic on issues of structure, culture, and agency, the use of SNA to craft strategies for tracking and disrupting dark networks cannot be. The constraints and opportunities afforded to actors by the networks in which they are embedded cannot be considered apart from the cultural influences, normative commitments, and instrumental concerns of the actors involved. For example, consider the issues surrounding the collection of kinship network data. What constitutes a kinship network in the West can differ considerably from what constitutes one in some Middle Eastern and Asian cultures. Or take, for instance, the FARC (Fuerzas Armadas

Revolucionarias de Colombia – Revolutionary Armed Forces of Colombia), the Colombian guerrilla group that is believed to be the oldest and, at its height, the largest guerrilla group in the world. It began as a Marxist-inspired movement in 1964 in order to protect rural peasants against the harsh policies and practices of large landowners; it also provided them with education in exchange for food and supplies (Metelits 2010). As it grew and sought additional funding sources for its activities, however, it turned to first the "taxing" and eventually the running of a substantial portion of the Colombian drug trade (Safford and Palacios 2002). Consequently, while it is likely that some of its members are ideologically motivated (i.e., Marxist), a substantial portion is probably only in it for the (drug) money. Thus, analysts may want to separately map the ideological and instrumental networks prior to crafting strategies to disrupt it.

1.6 Summary and Conclusion

This chapter has provided an overview of social network analysis, how it differs from other analytic approaches, the basic terms and concepts that it employs, and the key assumptions that underlie much, if not all, of what social network analysts do. These assumptions are often more implicit than explicit in the work of social network analysts, but nevertheless they are there (or at least one hopes they are). They provide the foundation on what we cover in later chapters. For instance, the various centrality metrics that we will examine provide analysts with a sense of actors' structural locations. Similarly, measures of density and centralization attempt to capture the overall structure of a social network. We will not always draw explicit ties between these assumptions and specific metrics, but we hope they become more obvious as you immerse yourself in this field. This chapter also took up the related issues of culture and human agency and what role these play in social network analysis. As we saw, not all social network analysts include human agency and culture into their causal models, but when it comes to crafting strategies for disrupting dark networks, such factors cannot be ignored. The crafting of strategies is the topic of the next chapter, to which we now turn.