INTRODUCTION: FROM METAPHOR TO METHOD TO WORLDVIEW

The network has become perhaps the dominant metaphor of our time, used to describe structures from the brain (neural networks) to malevolent social groupings (terrorist networks) to global computer communication systems (the World Wide Web). Defined simply, a network consists of "nodes" and "ties," or relationships among the nodes. Nodes can be actors—such as persons, groups, or organizations—or other entities, such as neurons or abstract ideas. Ties can take on endless forms, from physical linkages to personal relationships. From this definition, it is clear that networks have much in common with the open systems approach described in Chapter 4, where we conceived of organizations as systems of interdependent, loosely coupled parts, among which can flow materials, energy, and information. Just as living systems vary in level from the cell to the organization to the supranational system (Miller, 1978), networks can be used to describe systems at all levels of analysis. Networks are everywhere, from the microscopic cell to the planetary system.

In organizational life, there are interpersonal networks—within and across organizations—that influence who gets a job and who gets promoted as well as interorganizational networks created by exchanges of resources, alliances, and shared directors. Formal organizations are themselves a special case of network: roles (or jobs, or participants) are nodes connected by ties such as authority relations or information exchanges. And network forms of organization link specialists across the value chain into a single quasi firm. Dell Computer's founder Michael Dell describes how "virtual integration" (as opposed to vertical integration) weaves together Dell's suppliers and other customers into an integrated whole that looks and acts like a single organization (Child, 2005: 197). A customer sees "Dell," but behind the scenes are twenty or more firms knit together by an electronic nervous system of information technology.

NETWORK THINKING

Network thinking has a long history in sociology. Many consider Georg Simmel (1955 trans.), a German contemporary of Weber, to be a founder of the sociology of networks with his discussions of the dynamics of triads and the "web of group affiliations." Triads are, of course, small networks, but they have interesting possibilities. A friend of my friend may be a friend, and an enemy of my friend is likely to be an enemy—but there are more interesting possibilities when my friend acts as a broker (keeping the two of us separate and acting as a conduit), an arbitrator (mediating conflicts between us), or a spoiler (fomenting conflicts between us).

Surprisingly, the "sociogram"—the familiar network diagram showing circles (actors) linked by lines (relationships) that we now take for granted—was not invented until the 1930s, when Jacob Moreno (1953) created it as part of a new science of "sociometry." The sociogram, and the sociometric techniques for assessing interpersonal networks pioneered by Moreno and others, provided a basic analytical framework for measuring some of the mathematical properties of networks.[1] C. Wright Mills applied network ideas to analyze the social connections among members of the American "power elite"—"those political, economic, and military circles which, as an intricate set of overlapping cliques, share decisions having … national consequences" (Mills, 1956: 18). Mills's work launched a series of empirical studies of power elites in modern societies—all anchored in organizational connections—that continues up to the present time.

During the 1970s and 1980s, advances in network methodology and in computing power allowed the network metaphor to become systematized into a formal method of analysis. New constructs and measures were introduced at a rapid pace, and network methods allowed more rigorous means of testing ideas from theories such as resource dependence and institutional theory. Network theorists also introduced new ways of thinking about organizations, their structures, and their relationships. In this chapter, we provide an overview of network concepts and a review of networks in and around organizations that build on theories in the prior chapters to expand the domain of organizational analysis to broader social systems.

Varieties of Networks

A network is a system of relationships among parts. The parts are generally referred to as *nodes*, and the relationships or connections among the parts are *ties*. The underlying premise is that ties are often more influential in affecting behavior than the specific attributes of nodes—for example, demographic or psychological attributes of individuals. In addition, the behavior of a node is influenced not only by the ties in which it is directly involved, but also by the patterning of ties in the wider network structure.

Any organization or other social system can be represented as a network. Indeed, "network" is a general concept applicable at any level of analysis. A few examples of networks will illustrate this. Nodes can be people tied by friendship or acquaintanceship, as in the triads described by Simmel. This is the image that comes most readily to mind when we think of a "social network" or "networking," and a number of Web sites are devoted to mapping and facilitating networks for social (e.g., *Friendster.com*) and business purposes (e.g., *LinkedIn.com*). At a more fine grained level, one can map a conversational network by considering who talks to whom in a group (Gibson, 2005), which can reveal dynamics of power and status. Nodes can be film actors, such as Kevin Bacon and Julia Roberts, who are tied by acting together in the same film.[2]

Nodes can also be at higher levels of analysis. In fifteenth-century Florence, patriarchs of well-bred families routinely married their children off to each other to cement alliances among the families. Padgett and Ansell (1992) have mapped the Florentine family intermarriage network, where nodes are families and ties are marriages, to show the network prominence of Cosimo de Medici and his brood. Boards of directors often share members (or "interlocks"), as we saw in Chapter 8 and will discuss more fully later. These connections create two networks: in one, boards are the nodes connected by shared directors; in the other, directors are the nodes connected by shared board memberships.

Networks need not involve human beings at all. Pages on the World Wide Web can be considered nodes connected by hot links that direct browsers to and from each other. Who eats whom (or what) in an ecosystem, such as a pond, can be mapped as a network (albeit with only one-way connections!). For electric power grids, generators and transformers are odes tied by high-voltage transmission lines (see Watts and Strogatz, 1998 for analyses of these networks). And products bought on-line are nodes "connected" by common purchasers; thus, Valdis Krebs (*http://orgnet.com/divided2.html*) mapped the linkages among political best-sellers purchased on Amazon.com to find that those on the left and right rarely bought the same books during the 2004 election season, a telling sign of political polarization.

Key Concepts and Measures

Networks can be viewed at three analytical levels (see Burt, 1980; Kilduff and Tsai, 2003 for introductions to social network analysis). The first is the *ego network*, consisting of all a node's direct contacts. Although this is the simplest level, it can be quite informative. How many acquaintances do I have? How diverse are they? Do they know each other? Do they like each other? Do I rely on different friends for different things (e.g., playing sports, gossip, job tips)? This conception of network can also be applied at higher levels, for example, to an organization and its direct contacts to other organizations—identical to the concept of organization set.

The second level is the *overall network*, which includes all actors and relationships within a particular domain. If the ego network describes one's immediate social neighborhood, the overall network describes the larger topography of a region. At this level, we can ask how well connected or dense the network is, whether it is highly centralized around a few important actors or balkanized into separate clusters. This is a useful way to analyze networks within a particular organization and fits well with notions of hierarchical versus flat organizations, silos versus matrix organizations, and so on, but it can also be applied at the organizational level, describing the structure of an organizational field. At the third level, if the overall network describes topography, then *network position* identifies an actor's coordinates within that topography. What is my place in the larger system—am I prominent, holding a place at the center of the network, or peripheral, hanging around at the edges? Are my friends well connected, giving me a broad circle of friends of friends? Similarly, at the organizational level, we can ascertain what its location is in the field.

Before describing specific network measures, we note two general caveats. First, the meaning of different network measures depends entirely on the nature of the relationships being mapped, which can include friendship or hatred, corporate alliances or corporate lawsuits. Thus, being central in a network is not necessarily a good thing. Baker and Faulkner (1993) found that those managers who were most central in a famous price-fixing conspiracy network were most likely to be found guilty in court—more central meant

more witnesses—and most likely to do jail time! Second, networks are often "multiplex," meaning that different kinds of relationships often overlap. Coworkers can be friends; alliance partners may also share directors; directors on the same board could become romantically involved. It is important when analyzing networks to not lose sight of which specific relationships are being mapped.

Network analysts have developed several useful measures (see also Smith-Doerr and Powell, 2005).

- *Distance*. A basic measure in a network is the length of the shortest path between two actors, known as the "geodesic," or simply "distance." Friends (members of your ego network) are a distance of one, friends of friends are a distance of two, and so on. Imagine that you wanted to get from Bangor, Maine, to Santa Barbara, California, flying on an airline that only flew short hops between adjacent states. The smallest number of hops you could take is the geodesic distance for this trip on this airline. Social networks have a similar property, and distance can be thought of in terms of the question, Who do I know who can introduce me to *X*, or can introduce me to someone who knows *X* (say, Kevin Bacon)? A famous experiment by Stanley Milgram (1967) tried to calculate the distance between the average pair of adults in the United States and, along the way, coined the phrase "six degrees of separation." A random set of 160 Nebraskans was given a packet with the instruction to get the envelope to a stranger—specifically, a stockbroker who lived in suburban Boston—by relying on acquaintances who could forward the packet to someone who was likely to be closer to the stockbroker. The acquaintance would do the same thing until the packet eventually reached the target (the Boston broker). Milgram found that, on average, it took six passes between individuals for the packet to reach the broker—that is, people were separated by six degrees of separation. This came to be known as the "small world" phenomenon, after the common experience that, when we meet a stranger, we often find that we have an acquaintance in common—it is, indeed, a small world. The average distance between any two people (or organizations) is an important property of a network—information, fads, and diseases all spread more quickly when average distances are short (Watts, 1999).
- *Centrality*. Centrality describes how important an actor is in a system and is the most common measure of network position. Of course, there are many ways to be "important," and almost as many measures of centrality (Freeman, 1978/79; Wasserman and Faust, 1994: chap. 5). The simplest measure of centrality is *degree*, or how many direct contacts one has. (Put another way: how large is one's ego network?) Relationships can flow both ways and need not be reciprocal—millions of Web sites have links to the site for Adobe Acrobat, but the Acrobat site rarely links back to them. Thus, analysts distinguish between *in-degree* (how many ties flow toward you) and *out-degree* (how many ties flow outward from you). In-degree is often used as a measure of prestige in network analysis: those who are often named by others are particularly likely to be "important." In an important early study of relationships within a federal bureaucratic agency, Blau (1955) found that agents who were more often sought out for consultation on difficult cases enjoyed the highest status within the agency.

  A second measure of centrality is *closeness*, which describes how far (that is, how many degrees of separation on average) are all the other people in the network. A small number here means that one can easily reach friends of friends; thus, a closeness score of two means that the average person in the network is a friend of a friend, while a closeness score of three means the average person is a friend of a friend of a friend. A third centrality measure is *betweenness*. This asks: How often am I on the shortest path between any two other people in a network? An example illustrates this concept. In the Middle Ages, when roads were relatively undeveloped in Russia, trade goods often moved by river aboard boats (or, during the winter, sleds). Port cities arose at relatively regular points along the rivers as places for trading, getting supplies, and rest. Rivers, of course, form a network, and there are often many possible paths between any two cities. It happens that, when one plots the shortest path between all possible pairs of cities and ranks cities according to how often they were on these shortest paths, Moscow is at the top. That is, boats or sleds traveling by river between any given pair of cities were highly likely to stop in Moscow, making it an important port city—a crossroads, if you will—that ultimately grew in importance to become the national capital in 1328 (Pitts, 1978/79).

  Yet another measure of centrality is the *eigenvector* measure. Although the name is almost as unwieldy as the mathematics behind it, the intuition of this measure is straightforward: if degree asks "How many friends do I have?" the eigenvector measure asks, "Do I have many friends who themselves have many friends?" and so on. The search engine Google relies on a measure much like this: a Web page gets a high score to the extent that many other Web pages have links pointing to it, and these pages in turn are pointed to by many others. (Bonacich [1987] gives a more rigorous derivation.)
- *Clustering and structural holes*. In addition to knowing about someone's position in a network—their centrality—we might also want to know how connected or cohesive neighborhoods in a network are. Clustering asks, in short, Are your friends also friendly with each other? Within a family, we might expect that everyone is connected with everyone else, and thus clustering is very high. On the other hand, friends are less likely to be highly clustered. If you were to draw a sociogram of all your friends, with you at the center, then each pair of your friends who did not know each other would form an open triangle, with you in the middle and a gap in between. The fact that you are friends with both suggests that they would like each other if you introduced them, a phenomenon described by Fritz Heider's (1958) balance theory.

Ron Burt (1992b) labeled these gaps in social networks *structural holes* and documented the benefits to those whose ego networks have many structural holes. We mentioned above that Simmel described several possible triads, one of which centered on the broker or "tertius gaudens" ("third who benefits"), acting as a social bridge between people who do not know each other. This situation tends to arise for people who span social boundaries. For example, in Figure 11-1, Lois and Bill both work in design, and each has six friends at work (that is, their degree centrality is six). But while Bill's friends are all in design, and mostly know each other (that is, clustering is high among Bill's friends), Lois joined a cross-functional task force and stayed in touch with the colleagues she met in other departments. As a result, Lois can act as a bridge between these different departments, passing on information, opportunities, and requests—she is, in short, a "broker." The benefits to Lois are that she is likely to learn news faster than Bill and to have friends watching out for her interests at different places in the organization. Burt (1992b) argues that people who have networks rich in structural holes (such as Lois) frequently get better raises, faster promotions, and are in a better position to combine ideas into useful innovations.

Organizations can also benefit from having networks with structural holes within their organization set. For example, while most industrial design firms specialize in a particular industry (e.g., automotive parts), IDEO in Palo Alto, California, and Design Continuum in Boston, instead seek to work with clients in diverse industries because it allows their research staffs to find novel innovations that combine problems and solutions from disconnected domains. For instance, the idea for the Reebok Pump shoe, in which wearers pump up an inflatable cuff around their ankle to provide a better fit, came from prior work with a client that made stents for IV bags used in hospitals. Organizations like IDEO and Design Continuum, in short, are like Lois, acting as "knowledge brokers" by maintaining ties to diverse and disconnected industrial clients (see Hargadon and Sutton, 1997, for these and other examples).

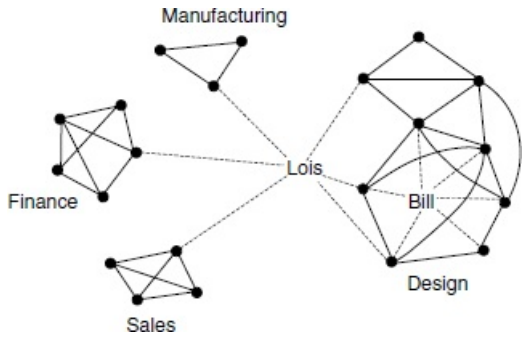

FIGURE 11-1 Networks at Work.
Source: Adapted from Burt (2000) and Baker (2000).

- *Equivalence*. Although each of us likes to believe that our situation is unique, network analysis emphasizes that many occupy similar locations in social systems. Two actors are *structurally equivalent* to the extent that they share the same pattern of relationships with other actors in a network. In the Sales Department in Figure 11-1, one person has a tie outside to Lois, while the other three are all tied to each other and to the first person. In network terms, they are equivalent. Note that the equivalent actors are not necessarily connected to each other—they simply have the same set of relationships to others. In practice, this may mean that they are competitors or substitutes. Companies that make disk drives for computers may buy from the same set of suppliers and sell to the same set of buyers—they are competitors, and structurally equivalent, even though they may be unaware of each other's existence. Institutional arguments regarding pressures toward isomorphism frequently apply to networks that are structurally equivalent (DiMaggio, 1986).
- *Density*. While clustering refers to ties among an ego network, density describes the extent to which all actors in an overall network who might be connected really are. More formally, density is the percentage of possible relations in a network that are actually observed. It provides a rough indication of a network's cohesion. Density tends to decrease with size, as the number of possible relationships increases geometrically with the number of nodes, according to the formula $[n^*(n - 1)]/2$ (where n is the number of actors in the network). With two people, there is one possible relationship, between A and B. With three people, there are three possible relationships: A-B, B-C, and A-C. With four, there are six: A-B, A-C, A-D, B-C, B-D, and C-D. In a group of fifty, there are (50*49) /2, or 1,225 possible relationships! Thus, if the average actor had five friends, then the density of the network quickly declines as it grows larger.
- *Centralization*. The final network-level measure we describe is centralization, which captures the extent to which some actors in a system are well connected and others are not. If everyone is equally central (by whichever centrality measure is used), then the centralization score is zero; if one person completely dominates the network, then centralization is one.

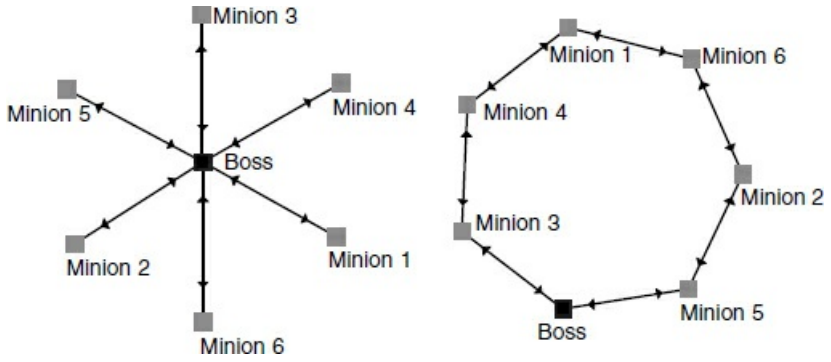

FIGURE 11-2 Centralized versus "Flat" Networks.

Centralization will typically vary with the level of hierarchy on the organization chart. Higher-ups tend to be much more central than lower-downs, and so an organization seeking to flatten its hierarchy should find centralization decreasing.

Networks as Pipes and Prisms

We have described networks in terms of actors and relationships, with the open systems notion that something flows between the actors—materials, energy, or information. Networks in this sense are like pipes, providing a conduit for resources and information to flow through. But Podolny (2001) points out that networks can also serve as prisms, refracting an actor's social position and indicating endorsement, status, or legitimacy—even if nothing in particular flows between the actors in the network. A famous anecdote illustrates this: "At the height of his wealth and success, the financier Baron de Rothschild was petitioned for a loan by an acquaintance. Reputedly, the great man replied, 'I won't give you a loan myself; but I will walk arm-in-arm with you across the floor of the Stock Exchange, and you soon shall have willing lenders to spare'" (Baker, 2000: 32). The prospective borrower's tie to Rothschild was not a pipe—the Baron was not going to provide him a loan—but a prism, a means to burnish his standing in the world. Those who have dealt with the boards of nonprofits, or dissertation committees, will know that similar dynamics play out in these contexts. As we will see later in the chapter, even investors in start-ups are sometimes recruited less for the resources they provide than for the appearance they create in the eyes of outside observers.

INTERORGANIZATIONAL NETWORKS

A large body of work on ties among organizations reflects the types of theories that predominated when network methods were being developed. In particular, resource dependence theory stressed the importance of networks of exchange among organizations and how they create power/dependence relations, as well as the formalized ties such as shared directors and alliances that organizations use to manage their interdependence (Pfeffer and Salancik, 1978). And institutional theorists use network imagery to describe constructs such as the structuration of organizational fields and the "emergence of sharply defined interorganizational structures of domination and patterns of coalition" (DiMaggio and Powell, 1983: 148). Researchers have mapped a large number of interorganizational networks, as we describe next.

Levels of Ties

As we have seen, networks exist within, across, and between organizations. All manner of ties exist among individuals within organizations: information flows, work-flow interdependence, friendship, and authority, among others. A similar range of ties exists between an organization and its exchange partners, competitors, and regulators. Perhaps the most widely studied network at the organization level is the interlocking directorate network created by shared directors on boards. We review these studies below. Another type of tie at the organization level is the alliance, which can range from short-term ties among firms or agencies for particular projects or long-term relationships and joint ventures. Such connections can give rise to new structures of network organizations, as we describe.

Network analysis can also be used as a tool for measuring organizational context. Networks can be created through common affiliations with a third party. For instance, companies can be "tied" through a shared owner. U.S. railroads in the early part of the twentieth century were organized into identifiable (but latent) "communities of interest" that shared both common owners and directors (Roy and Bonacich, 1988). Venture capitalists (VCs) also create implicit "communities" among their portfolio firms, as VCs can facilitate sharing information, best practices, and, potentially, exchanges among the businesses in which they invest. Just as being affiliated with the same owner can connect companies, they can be connected as a result of being covered by the same financial analysts. Zuckerman (1999) used such information to map distances and industry "neighborhoods" among firms based on analyst coverage. Patents that companies file include references much like academic papers; just as intellectual neighborhoods can be identified by patterns of academic citations, technological neighborhoods and distances among patented technologies can be mapped using patent citation data (Podolny and Stuart, 1995). And products bought by the same consumers on Amazon.com are thereby connected, creating "product neighborhood" networks. (To analyze the shortest paths between pairs of products, visit *http://www.baconizer.com/*.)

German firms are connected by relatively short paths via shared owners, and shorter paths between firms often led to mergers (Kogut and Walker, 2001). On the other hand, several hundred large U.S. firms are implicitly connected by having Fidelity as their largest shareholder, but there is no evidence that this translates into shared directors, business ties, or mergers (Davis and Yoo, 2003). But ownership and other dyadic ties often overlap (that is, they are "multiplex"): Fidelity is the largest shareholder in corporate America, but it is also one of the largest providers of employee benefits services (such as running corporate pension plans),

which implies that it is frequently in a position of voting on the proposals of boards and managers that it depends on for business (Davis and Kim, 2005).

Finally, when we described dyadic approaches to the environment in Chapter 9, we noted that the entire economy (or polity) can be seen as a giant web of exchange. We briefly review work at the sector and societal level below.

Exchange Networks among Organizations

Exchange is perhaps the most basic tie in a market economy, and the question of why some ties endure and others do not is a central one for businesses. Several scholars have studied how long exchange relationships with professional firms endure, using the same techniques ecologists used to study organizational births and deaths to understand the "births" and "deaths" of relationships. A study of auditors revealed a "liability of adolescence" in the length of time that corporations retained their accounting firms. Following an initial honeymoon period in which auditors were relatively safe, the rate of breakup increased up to a maximum point (perhaps similar to a "seven-year itch") and then declined again with time as, apparently, firms and their auditors became invested in their relationship (Levinthal and Fichman, 1988). (An interesting exception to this general pattern was Arthur Andersen's implosion following Enron, where clients rushed to the exit in a rapid contagion process—see Jensen [2006].) Baker and colleagues (1998) found a similar U-curve pattern for firms' ties to advertising agencies, although the peak year for risk of breakup was much later, at eleven years. Such business ties are evidently overlaid with social ties as well. Broschak (2004) found that ad agencies were more likely to turn over when the managers they dealt with at the client firm exited. And corporations that were issuing bonds were more likely to choose commercial banks as lead underwriter—a relatively new line of business for the banks enabled by financial de-regulation—when the firm had done other types of business with the bank previously (Jensen, 2003).

Beyond specific dyadic ties among firms, researchers have also considered the impact of a firm's portfolio of ties with its organization set. In the New York garment industry, as in other contexts, there are clear advantages to having strong ties with clients—loyalty, trust, and better information—but there are also risks that accompany being overly dependent on a single partner. Thus, Uzzi (1996) found that firms did best—that is, were least likely to fail in a given year—when they had a mix of strong and weak ties. In a subsequent study, he found that corporate law firms charged lower hourly rates to the extent that they had a portfolio of longer-term clients, but higher rates to the extent that its lawyers served on major corporate boards and the firm served high-status clients (Uzzi and Lancaster, 2004).

Interlock Networks

Academic and policy concern with interlocks dates back to Justice Brandeis (1914), who argued that bankers dominated the economy by placing their representatives on corporate boards, and Lenin (1939 trans.), who pointed out that this was the case for most capitalist economies.[3] While the earliest writings reflected anxiety about concentrated economic power (Roe, 1994) and hinted at an almost conspiratorial process centered around banks, subsequent work suggested a more structural interpretation of pervasive interlocks. Mills (1956) argued that connections among elites from the corporate, military, and governmental realms had become increasingly national in character, in part as a result of the mobilization for the Second World War.

Because of this increased concentration of power at the national level, it was almost inevitable that elites at the head of the most important institutions would come to know each other, to socialize, and to evolve more-or-less shared opinions. By midcentury, however, banks had become relatively less important to this process as their clients grew to national and international scope. "Not 'Wall Street financiers' or bankers, but large owners and executives in their self-financing corporations hold the keys of economic power" (Mills, 1956: 125).

Debates around banks and the place of interlocks continued through the 1980s. Mizruchi (1982) documented that banks had been central continuously since the days of JP Morgan at the turn of the century. Mintz and Schwartz (1985) analyzed in detail the sources of bank centrality in the 1960s and argued that although bank centrality was economically significant, banks did not "dominate" companies, certainly not through board ties. Rather, banks recruited well-connected executives to serve on their boards to provide high-level intelligence about the operations of the economy, which the bank could then use to guide investment choices. But during the 1980s and 1990s, corporations increasingly turned away from commercial banks for their financing and relied instead on markets for debt, thus removing the primary franchise of the banks. As a result, banks consolidated, shrank their boards, and moved into other lines of business, such as securities underwriting, and by the mid-1990s, they were no longer particularly central in the interlock network (Davis and Mizruchi, 1999).

Antecedents of Interlocks. The consensus view of board interlocks currently is that they are primarily a source of information (or "business scan"—Useem [1984]) rather than a device for interorganizational control. But why do particular organizations choose to share directors with each other? The most influential view was that organizations used board membership as a form of cooptation—that is, inviting a source of vital resources to serve as an insider on the board in order to gain their favor. Resource dependence theorists documented that shared directorships across industries mapped onto interindustry resource flows, consistent with the idea that companies were inviting executives of troublesome buyers or suppliers to serve on their boards (Burt, 1983; Pfeffer and Salancik, 1978). Shared directors within broad industry sectors were also most likely to be found at intermediate levels of concentration, which was argued to be the situation entailing the most competitive constraint. But the evidence supporting these arguments was at the industry level of analysis, not the firm level. Moreover, the industry level used in most studies was highly aggregated: for example, industry sector 28 ("chemicals") included heavy chemical makers such as Dow and DuPont, drug companies such as Merck and Pfizer, cosmetics firms like Avon and Revlon, and paint makers like Sherwin-Williams. When analyzed at more disaggregated levels, the data showed that interlocks among genuine competitors in the late 1960s were essentially nonexistent (Zajac, 1988).

Similarly, data from the 1990s showed that large corporate boards in the United States only rarely included executives of major buyers or suppliers (Davis, 1996). And when a shared director retired or died, thus severing a tie between a pair of companies, they were replaced with another shared director only about one time in six during the 1960s (Palmer, 1983). The evidence, in short, suggests that board ties among U.S. corporations are not used primarily to manage interorganizational interdependence.

Why do firms recruit the directors they do? For much the same reason that individuals choose particular people to befriend: proximity.[4] Companies located in the same city were more likely to reconstitute broken ties

than those in different cities during the 1960s (Palmer, Friedland, and Singh, 1986); businesses in cities with elite social clubs (which provide a place for elites to meet) were more likely to share directors (Kono et al., 1998); companies are more likely to recruit directors from the boards where their current directors already served (Davis, Yoo, and Baker, 2003); and there is a clear geographic clustering by city in the interlock network, particularly in cities with a prior history of interlocking (Marquis, 2003).

To put it another way: boards in general recruit individuals, not "interorganizational ties." What characteristics make a candidate attractive may vary among selectors. Existing board members may want to recruit engaged directors who are likely to get along well with the current board, whereas CEOs might prefer more compliant directors (Zajac and Westphal, 1996). And individuals who are already well connected (e.g., by serving on a lot of boards, or by serving on boards whose directors in turn serve on a lot of boards) are more likely to be mentioned as potential candidates (Davis, Yoo, and Baker, 2003). But they are recruited as individuals; the corporate ties they bring appear to be somewhat fortuitous.

Consequences of Interlocks. Fortuitous ties, however, turn out to be consequential. Michel Useem (1984) interviewed dozens of directors in the United States and the United Kingdom and found that a major attraction for serving on a board is "business scan": directors who serve on several boards have access to high-level intelligence from which their own organizations can benefit. For example, CEOs learn about acquisitions from serving on outside boards, particularly if they lack ties to other sources of intelligence, such as business associations (Haunschild and Beckman, 1998). Well-connected CEOs engaged in more acquisitions in the 1960s (Palmer and Barber, 2001) and the 1980s (Haunschild, 1993) than did their less-connected peers. Such board ties are particularly valuable when they connect the firm to diverse sources of information, such as partners who have had a variety of experiences with acquisitions (Beckman and Haunschild, 2002). Board ties to local philanthropic leaders shaped the level of charitable giving by their firms: companies in Minneapolis/St. Paul whose executives had more contact with the philanthropic elite (through serving on the same corporate or nonprofit boards and through membership in the same elite clubs) made greater contributions than those with fewer contacts (Galaskiewicz, 1997).

Because of the dense connections among firms created through shared directors, one might expect that firms are especially susceptible to contagions, just as children in day care are routinely exposed to new viruses. A number of studies have shown that corporate practices and structures diffuse through board ties. This should not be too surprising: companies often face the same problems (e.g., which investment bank to use, what countries to invest in, how to fire the CEO without alarming Wall Street), and shared directors often confront the same problems on several boards. Thus, companies more readily adopted the "poison pill" takeover defense in the mid-1980s to the extent that their directors served on other boards that had done so—a contagion process that led most large U.S. corporations to adopt a pill over a brief period (Davis and Greve, 1997). Similar ties encouraged firms to create an investor relations office to deal with their institutional owners when they heard about it via a shared director (Rao and Sivakumar, 1999). During the 1960s, companies whose outside (nonexecutive) directors had ties to directors of companies with an M-form were more likely to adopt this structure themselves (Palmer, Jennings, and Zhou, 1993). And companies listed on the Nasdaq stock market frequently "defected" to the New York Stock Exchange—Nasdaq's major rival—when companies with which they shared directors had done so, although this effect was dampened among

firms sharing directors with other, nondefecting Nasdaq firms (Rao, Davis, and Ward, 2000). Organizations, it seems, can get caught up in contagions (not to say fads) in much the same way as individuals.

Ties among boards have documented effects on decision making and on the spread of information. Surprisingly however, there is virtually no evidence that they influence economic performance, at least in the United States (see Mizruchi, 1996 for a review). Organizations may try to direct their interlocks at sources of constraint, or recruit well-connected directors to impress their investors (à la Baron de Rothschild), but it doesn't seem to help their profitability. Nonetheless, interlocks continue to be widespread in most economies —in 2003, the average large U.S. corporation shared directors with six other large corporations, and there is little sign of decline in their prevalence.

NETWORK FORMS OF ORGANIZATION

After seeing the enormous range of contexts that can be described as "networks," it should come as no surprise that the notion of a "network organization" did not have a consensus meaning, at least initially (see Podolny and Page, 1998 for a review). Baker defined the network organization as "a social network that is *integrated* across formal boundaries. Interpersonal ties are formed without respect to formal groups or categories" (1992: 398). As an illustration he described a commercial real estate firm that had many formal boundaries internally (based on the type of real estate sold, geography, or rank in the organization), but where information flows and social relationships were not substantially constrained by these boundaries. Miles and Snow define network forms as "clusters of firms or specialist units coordinated by market mechanisms instead of chains of command" (1992: 53). These definitions highlight very different aspects of networks: in the first case, *social relations* that cross formal boundaries are the essence of the network, while in the second, the critical characteristic is that *market mechanisms* mediate relationships among formal units. We consider these types of "network organizations" as well as the kinds of networks that arise *inside* organizations and those that arise *among* organizations.

Internal Networks

As we observed in our discussions of organizations as natural systems, the organization chart captures at best a small part of the network of social ties within organizations. The studies of Western Electric's Hawthorne Works during the 1930s, described in Chapter 3, documented the dense pattern of relationships —positive and negative—that arose among co-workers assembling telephone switchboard banks, and how those networks influenced employee productivity. When MIT erected married student housing for returning GIs after World War II, social psychologists seized the opportunity to examine the patterns of social ties that emerged among strangers randomly assigned to be neighbors. They found the predominant determinant of social relationships to be mere proximity—near-by neighbors turned into friends, and the most popular students were those whose apartments were along the most traveled paths (e.g., those housed near the stairways or trash bins). Moreover, the groupings that arose had important influences on the flows of information among neighbors and even the kinds of opinions they held (Festinger, Schachter, and Back, 1950). Subsequent research on R&D labs at MIT documented that the same processes often happened at work—the "Allen curve" describes the inverse relation between how distant any two engineers' offices were and how often they communicated (Allen, 1984). And, as one would expect, the formal structure of the organization (e.g., who is housed in the same department) also influences which relationships form (Baker, 1992).

Whatever their source, social networks at work have an important influence on who gets hired, how well they perform, how much they get paid, and how their careers progress. Many employees find their jobs through tips they hear from personal contacts—usually acquaintances ("weak ties") rather than friends or family (Granovetter, 1973)—and some organizations have sought to harness this process as a low-cost way to recruit new employees. Fernandez and associates (2000) studied employee referrals at a call center within a large national bank, which paid workers a bonus when those they recommended for jobs ended up being hired by the bank. They found that this method was quite cost-effective and resulted in a pool of applicants better

suited for these positions. Network properties also matter for career advancement: employees with networks rich in structural holes were promoted faster than colleagues without such networks (Burt, 1992b), although which network was "right" from the employee's perspective differed among men and women, and minority versus majority employees (Ibarra, 1995). Getting things done at work also often requires fitting the right network to the task: bankers consulted their most trusted colleagues within the bank for advice about uncertain transactions, but to get approval for the deal, they were better off relying on more dispersed networks for political reasons (Mizruchi and Stearns, 2001). And employees with networks more like Lois in Figure 11-1 tended to have more innovative ideas than those with networks like Bill. Much as IDEO generates innovation by juxtaposing concepts from diverse contexts, employees come up with better ideas when they are at a "crossroads" that spans different social domains within the organization (Burt, 2004).

External Networks

While the dominant trend among U.S. organizations after World War II was to grow ever larger and more vertically integrated, beginning in the 1980s this tendency reversed course, as outsourcing and focusing on a "core competence" took hold. The organizational outcome was the increasing prevalence of network organizations that combined legally separate firms along a value chain into a loosely integrated whole. We described examples of this, such as the garment industry, in Chapter 9. Miles and Snow (1992) provide a definition and a rationale for these forms. In their account, network organizations entail specialist units that have more-or-less long-term relationships among them that fall somewhere between the "make" or "buy" alternatives also described in Chapter 9. An essential feature of their definition is that the units face a market test—that is, if the price or performance that one of the units offers is not good enough, it can be replaced. For instance, if a computer maker has an internal disk drive unit, it will have a hard time switching to an outside supplier that is cheaper or has higher quality; but if the computer maker buys on the market—even from a long-time supplier—it always has the possibility of switching. This exposes suppliers to competition which, in principle, keeps them more focused and adaptive than they would be as "captive" internal units.[5] From the computer maker's perspective, it has the option to buy components from the best in the world, and this option gives them better information in negotiating with suppliers and in designing future products. Moreover, it allows the lead firm to rapidly scale up production when the market for their goods requires it.

If outsourcing has so many advantages over vertical integration, and (as we saw in Chapter 9) vertical integration is so costly, why did the outsourcing movement take place only recently? We point to two factors. First, recent advances in information and communications technologies (ICTs) have greatly reduced the cost of finding outside suppliers. Consider what would be required to find a supplier for a specialized component and to monitor their performance without e-mail, faxes, or the Internet. ICTs have greatly reduced the transaction costs of outsourcing and accordingly expanded the range of possible organizational forms. (Coase [1937] noted how the invention of the telephone created a regime shift earlier in the opposite direction, enabling the growth of firms with far-flung units by lowering the cost of rapid communication within the organization.)

A second factor encouraging the spread of outsourcing is a generalized rationalization and standardization of organizational practices (Scott, 2004b: 11–12). Common education in business schools, standardized contracts such as franchise agreements, similarity in structural forms, and widely emulated

exemplars of "best practices" in business have made organizations more and more alike, a central theme of institutional theory (see Chapter 10). And just as the use of standardized components enabled a huge increase in the production of muskets and other goods during the industrial revolution, standardization at societal and transnational levels has also greatly increased the production of new organizations and organizational forms. "After all, the building blocks for organizations come to be littered around the societal landscape; it takes only a little entrepreneurial energy to assemble them into a structure" (Meyer and Rowan, 1977: 345; see also Brunsson and Jacobson, 2000; Sahlen-Andersson and Engwall, 2002).

As an example, consider airlines. Dozens of airlines have been started in the United States in the past decade, some aiming for a national scope (e.g., JetBlue) and others serving a few highly specialized routes (e.g., Newark to Fort Lauderdale). Government deregulation aimed at encouraging competition laid the groundwork for this surge of start-ups, but equally important was the availability of contractors that could be hired to perform just about any task a new airline requires, from writing the application required for government certification, to selling the tickets, staffing the gates at airports, catering the food, and even flying the planes. Hundreds of second- and third-hand jets that used to belong to now-defunct airlines sit in the Arizona desert waiting to be sold or leased to new airlines by equipment-leasing units of banks and other firms. Venture capitalists, seeing the rapid revenue growth and low cost structure of some upstart airlines, often provide the seed money for start-up. And some major airlines themselves offer consulting, employee training, reservation services, and aircraft maintenance for their new competitors. In the wake of the terrorist attacks on September 11, 2001, many of the large carriers substantially retrenched, furloughing workers and canceling orders for planes that were already in production. These resources became available to newer and smaller carriers to expand their own operations, which typically faced lower costs than their larger rivals (*Wall Street Journal*, 8/12/04). To paraphrase Meyer and Rowan (1977), the building blocks (and capital) for airlines sit like ready-to-assemble furniture at Ikea so that creating an organization evidently requires only a set of instructions and a little entrepreneurial energy.

Types of Network Organizations

In their discussion of network forms, Miles and Snow describe three main types. In a *stable network*, "a large core firm creates market-based linkages to a limited set of upstream and/or downstream partners" (Miles and Snow, 1992: 64), while these partners also serve firms outside the network, which keeps them competitive. These networks occur mostly in relatively mature industries. Nike, for instances, concentrates its internal resources on R&D and marketing, while almost all production is outsourced to Asian manufacturers, which are allowed and even encouraged to produce for competitors such as Adidas in order to stay competitive (Miles and Snow, 1994: chap. 7).

Ties in a stable network are relatively long-lived. In contrast, in a *dynamic network*, "independent business elements along the value chain form temporary alliances from among a large pool of potential partners" (Miles and Snow, 1992: 64). Dynamic networks are seen in industries with relatively short product cycles. For example, in high-end fashion production, such as in the garment district in New York, a lead firm pulls together a project group of specialist firms for creating each season's line of clothing (Uzzi, 1997). The next product line may or may not draw on the same units; each new line is like a project with a relatively limited duration. Hollywood film production has a similar structure, with actors, producers, directors, and

cinematographers coming together to make specific movies; they may or may not work together on subsequent projects (Faulkner and Anderson, 1987). Note that in earlier decades when movies confronted less competition and demand was more stable, movie studios were more vertically integrated: they retained stables of actors, writers, and directors on long-term contracts and often owned the theaters where the movies were exhibited. In fast-moving high-tech industries, Sturgeon (2002) describes modular production networks in which a lead firm (the inaptly named OEM or "original equipment manufacturer") focuses primarily on product design, while other contractors specialize in manufacturing. "Generic" electronics manufacturers such as Flextronics, Solectron, SCI Systems, and Jabil Circuit, formerly known as "box stuffers," have taken on an increasingly important role performing generalized high-tech production. Their existence means that a company with a saleable product design (e.g., for a cell phone or personal digital assistant), but little capital to invest, can rapidly scale up production without owning its own production facilities—and scale down again when, as often happens, their design is superceded.

Finally, in an *internal network,* "organizational units buy and sell goods and services among themselves at prices established in the open market" (Miles and Snow, 1992: 65). This form brings market transactions inside the organization's boundaries; even staff departments, such as human resources, may face competition from external vendors that might provide better service at a lower cost. Taking the example of our computer manufacturer, the internal disk drive unit may offer its products to both its internal "customers" and to external buyers; their corporate siblings, in turn, may turn to external disk drive producers for some or all of their supplies. ABB, for instance, organized in the 1990s as a federation of 1,300 local companies linked into a global matrix, seeking to be both "small" (through the connection of local companies to their domestic and global markets) and "large" at the same time (Miles and Snow, 1994: chap. 7).

One of the most studied network organizations is Dell Computer, famously founded in Michael Dell's college dorm room in the early 1980s and now one of the world's largest producers of personal computers (see Child, 2005: 214–19). In contrast to the value chain in a traditional model of computer production, where manufacturers assemble PCs that are brought by distributors to retailers and sit in inventory until their purchase by a final consumer, Dell pioneered the "Direct from Dell" model in which a customized order from a consumer—initially by phone, now primarily over the Web—set the production process in motion. Dell relays orders for required parts to suppliers, who ship the parts to Dell for final assembly and shipment to customers via a "delivery partner" such as UPS. (Highly trusted suppliers of freestanding components, such as Sony monitors, are shipped directly by the supplier to the customer.) Dell's top suppliers are privy to Supplier Web Pages that give access to real-time data on customer orders in different segments and that facilitate communication and coordination. Dell also works closely with its largest corporate customers, offering services such as preloaded software, or even having Dell staff work on-site for customers such as Boeing. This system, which Dell calls "virtual integration," allow the parts of the network, led by Dell, to coordinate like a single organization, while keeping costly inventory to an absolute minimum and providing customized products to end users.

While our examples of network forms have been drawn primarily from business, many traditional government agencies—the archetype bureaucracy—have also undergone restructuring, moving toward networklike forms. Public agencies have been joined by hybrid forms, such as government corporations and government-sponsored enterprises, which attempt to build in various types of market controls. Moreover,

more and more governmental agencies contract out particular tasks to private companies, to both for-profit and nonprofit forms, in the belief that competition among and specialization of such providers will improve the efficiency of governmental services. Public organizations find themselves operating in the world of partnerships and networks (see Brooks, Liebman, and Schelling, 1984; Osborne and Gaebler, 1992; Rosenau, 2000; Salamon, 2002). And nonprofit organizations can also take on sophisticated network structures: Provan and Milward (1995), for instance, analyze the network structures of community mental health systems and the impact of different networks on the quality of patient outcomes.

Whereas Miles and Snow's typology takes the perspective of a particular organization—the lead firm and its organization set, or ego network—Bennett Harrison (1994) proposes a typology emphasizing differences in overall network.

1. *Networks in craft-type industries*. In these forms, work is organized around specific projects and involves the temporary cooperation of varying combinations of skilled workers. Examples include construction projects and artistic productions such as publishing or filmmaking (see Becker, 1982; Hirsch, 1972; Stinchcombe, 1959).
2. *Small firm-led industrial districts*. These network forms include the northern Italian industrial districts, with textile companies such as Benetton (Belussi, 1989), and the semiconductor firms in Silicon Valley (Saxenian, 1994).
3. *Geographically clustered big-firm-led production systems*. These forms include the well-known Asian examples of *keiretsu* ("societies of business") as well as connections that have developed between central assembly firms and multitudes of small suppliers; for example, Volvo of Sweden (Håkansson, 1989) or U.S. automobile companies (Helper, 1991).
4. *Strategic alliances*. Alliances of this type are increasingly found among firms of all sorts, but especially in new knowledge-based industries such as biotechnology

   (Barley, Freeman, and Hybels, 1992; Powell, Koput, and Smith-Doerr, 1996) and among large firms attempting to secure competitive advantage in a global environment. The ties may involve equity (subsidiary forms) or be based on contractual agreements (Beamish and Killing, 1997; Kanter, 1994), as we describe below.

Whereas some analysts such as Piore and Sabel (1984) and Perrow (1992) have proclaimed that small-firm networks are the wave of the future and likely to outcompete and outmaneuver larger and presumably less flexible forms, others such as Kanter (1989) and Harrison (1994) argue that large-scale firms have both the power and resources to prevail in the long run by developing strategic alliances under their control. Harrison describes these systems as composed of one lead firm orchestrating the contributions of a "core-ring" set of related, subordinate firms, whether suppliers or mer-chandizers. At the moment, both forms, which we will generically refer to as industrial districts, are prevalent in different industries.

Industrial districts can be seen as a functional alternative to the vertically integrated firm, and as documented by Piore and Sabel (1984), they thrive in particular industrial and social contexts, although they went largely ignored in the academic literature following their naming by Alfred Marshall. An *industrial district* is "a socioterritorial entity which is characterized by the active presence of both a community of people and a population of firms in one naturally and historically bounded area" (Becattini, 1990: 39). In addition to Silicon Valley, familiar examples include Detroit for cars, Hollywood for movies, and Wall Street for finance. In each case, the city or district came to be a metonym for an industry even after much of the actual work was dispersed to other areas. Hedge funds, for instance, now cluster largely in Greenwich, Connecticut, where taxes are considerably lower than on Wall Street in New York.

Why are there industrial districts—what are the benefits of agglomeration for organizations? Marshall pointed to several: access to information ("The mysteries of the trade become no mysteries, but are as itwere in

the air" [1890: IV.X.7]), access to relevant labor and other inputs (e.g., iron ore for steelmaking), and increased firm-level specialization. A two-person firm that specializes in sewing pleats on skirts is more likely to find enough work to occupy it in New York's garment district than in Topeka, Kansas. And sociologists have pointed out that physical proximity enables the development of trusting relationships among participants: while Dell may rely on the Internet to manage relations with suppliers, knitwear producers in Modena, Italy, prefer face-to-face contact (Lazerson, 1995).

Yet industrial districts are not without drawbacks—otherwise, one might see all sweaters made in Modena, all cars made in Detroit, all computers made in Austin, Texas. Sorenson and Audia (2000) argue that agglomeration is a mixed blessing—while new firms find it easier to recruit skilled labor, established firms find that their workers get poached by start-ups, and now face competition for customers from their neighbors. Thus, in a study of American shoe manufacturers, they find that the density of local shoe firms increases both birth rates (as one would expect from Marshall and followers) *and* death rates of shoemakers, although this eventually declined with age. And Paniccia (1998) points out that the industrial districts that have received the greatest attention are the unusually successful ones, such as Silicon Valley, which may not be particularly representative of industrial districts overall—an example of "sampling on the dependent variable." Comparing twenty-four small- and medium-sized Italian enterprise districts over forty years revealed that few looked like the idealized settings described in work on Northern Italy or Silicon Valley: performance was sometimes poor, and social connections, rather than always facilitating trust and cooperation, could also enable free-riding, deceit, and opportunism, as one would expect based on Granovetter's (1985) discussion of embeddedness.

Not all business groupings are rooted in geography. Granovetter (2005) points out that groupings based on factors other than geography are far more common than is recognized in the literature—indeed, he argues, they are pervasive in all known economies. As Polanyi (1944) put it in *The Great Transformation*, "Man's economy, as a rule, is submerged in his social relationships." Granovetter defines a business group as "sets of legally separate firms bound together in persistent formal and/or informal ways" (2005: 429) and gives a number of examples: keiretsu in Japan, chaebol in Korea, grupos economicas in Latin America, family-owned pyramids in Europe and Canada—all entail relatively strong ties among members such that understanding a group member requires knowing about its group.

While the reputation of industrial districts has perhaps been unjustifiably positive (Paniccia, 1998), business groups are often derided as "crony capitalism" that allow family ties and favoritism to trump hardheaded business decision making, and even to impede national economic growth. Morck, Stangeland, and Yeung (2000) coined the phrase "Canadian disease" to describe a process by which wealthy elites (e.g., heirs of entrenched business dynasties) use their political power to promote policies that impede entrepreneurship, which they perceive as a threat to their dominance, to the detriment of the larger economy. Modigliani and Perotti (2000) argue that networks are a second-best system for societies that lack the institutional infrastructure to support more efficient and frictionless arm's-length transactions. Yet Evans (1995) points to the central role of chaebol networks in the rapid industrialization of South Korea: through government-directed investment in key industrial sectors, a handful of South Korean chaebols helped turn a peasant economy into a high-tech powerhouse in just two generations following the Korean War.

One way to reconcile these divergent views of the impact of business groups is to link them to a society's

stage of economic development. Late industrializers, such as South Korea, had a relatively clear path to industrialization based on the experience of its predecessors: some industries (e.g., steel) are like keystone species in an ecosystem, others (perhaps autos and shipbuilding) are attractive for building export-oriented growth. In each case, businesses could directly emulate the best technologies and practices in the world, bypassing the tortuous path that led there for the earlier industrializers. Business groups with centralized financing, such as the conglomerate chaebols, can benefit from economies of scale in building up such industries. Once an economy has achieved rough parity with other industrials, future growth is driven more by uncertain industries in which placing many bets on independent firms is sensible, which favors more focused firms financed by markets. Kock and Guillén (2001) offer a complementary argument for why different organizational forms are most appropriate at different stages from the entrepreneur's perspective: early on, entrepreneurs build diversified groups (such as the chaebol) because their skills at bringing extant foreign technologies to local markets are broadly applicable across sectors. Eventually, however, such unwieldy forms give way to more focused organizations, although the original ties may linger on, as the keiretsu networks succeeded the zaibatsu in Japan after World War II.

Alliance Networks

Alliances can take many forms and serve many purposes. Child (2005: chap. 10) provides a useful typology of alliances and other interfirm linkages (see Figure 11-3) and describes several rationales for their use: to reduce risk, to attain economies of scale, for technology exchange, to preempt or co-opt competition, to overcome governmental barriers, to facilitate international expansion; and as a form of vertical quasi integration (see Contractor and Lorange, 1988).

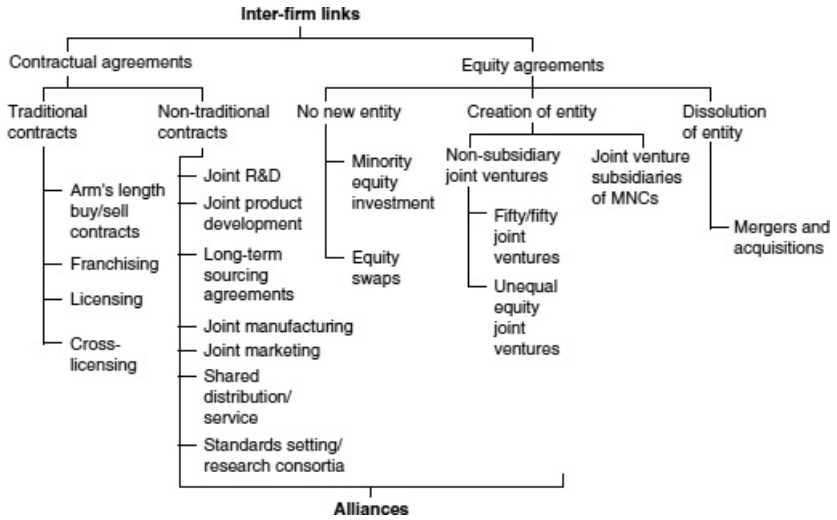

FIGURE 11-3 Typology of Interfirm Linkages.
Source: Child (2005: 224).

Alliances, or relatively formalized connections among firms that fall short of acquisition, vastly increased in prevalence during the 1980s and 1990s, just as traditional forms of diversification and vertical integration declined in the United States. We have argued that this is driven by a combination of a regime shift in transaction costs and by a generalized organizational rationalization in society, which enables relatively

frictionless combinations based on standardized practice. With the flowering of alliance forms has come a wave of research on the causes and consequences of alliances. Much of this work resembles that on interlocks, but research on alliances has also more fully engaged core questions about network origins and evolution. Where connections among firms seem at best a "bonus" that comes with recruiting a particular director, alliances entail genuine relationships among organizations, and in that sense they are analogous to friendship and other social networks.

Antecedents of Alliances. We have described several strategic reasons that organizations undertake alliances. But the choice of which particular partner to work with requires a more social explanation. First, some organizations are simply more attractive as alliance partners. Semiconductor firms with more widely cited patents formed more alliances than those with less influential patents (Stuart, 1998). In the biotechnology industry, firms with more R&D alliances were able subsequently to gain more alliances of other types, and the greater their centrality in these networks, the greater their rate of growth and the greater their likelihood of going public (Powell, Koput, and Smith-Doerr, 1996). In investment banking, firms may prefer to ally with those of a similar status, particularly when entering an uncertain market such as junk bonds (Podolny, 1994).

Second, the propensity to form alliances can depend on the joint characteristics of a potential pair—such as their prior history of alliances, or having partners in common—and on their broader surroundings. In a study of alliances among European, Japanese, and American firms in the new materials, industrial automation, and automotive industries from 1981 to 1989, Gulati (1995) found that the likelihood of two firms forming an alliance during a given year was greater when they had previously engaged in alliances with each other, when they had alliance partners in common, and when their geodesic in the alliance network was short. Of course, alliances cannot always depend on prior alliances—new firms have to start somewhere. Rosenkopf and colleagues (2001) found that alliances among firms in the cellphone industry were more common when engineers and managers from the firms had worked together on technical committees—which allowed them to scope out potential partners—but this effect declined when the firms had prior alliances—which presumably gave sufficient information about their suitability as partners. A follow-up paper to Gulati (1995) found that alliances were more likely among partners that were both jointly central (using the eigenvector measure described above), and when the larger alliance network in the industry was itself centralized (again, by our prior definition). Moreover, interdependence between potential partners increased the likelihood of alliance, but this effect became weaker as the overall network became more centralized, while the effect of the potential partners' joint centrality increased as the network became more centralized (Gulati and Gargiulo, 1999). This study suggests a complex dynamic in which the likelihood of firms forming a tie depends on their individual characteristics, their ego networks and network positions, their character as a dyad, and the shape of the broader network in which they are embedded. Finally, while differences in partners' centrality or status may reduce the propensity to form alliances, differences in technological capabilities enhance it—up to a point. Firms receive little benefit from allying with those that overlap with them substantially in their technological resources (after all, such firms are likely to be direct competitors), but those with no overlap might be too distant to be comprehensible. Drawing on patents and patent citation patterns to track technological overlap and distance among firms, Mowery and colleagues (1996) report evidence consistent

with this argument.

Consequences of Alliances. Unlike interlocks, alliances appear to influence organizational performance, both in terms of innovation and speed. Biotech firms with diverse portfolios of alliances tend to become more central, and thus to grow faster (Powell, Koput, and Smith-Doerr, 1996), and such firms were faster to go public (through an initial public offering, or IPO) when they had prominent equity investors (i.e., firms that themselves held well-cited patents and had many alliances), particularly in the case of firms that were younger and therefore harder to assess (Stuart, Hoang, and Hybels, 1999). More broadly, affiliations with prominent outsiders generally bring the greatest benefit as a form of endorsement when uncertainty is high and the quality of an organization's work is difficult for outsiders to evaluate—for example, in investment banking (Podolny, 1993). Finally, although we have described the potential benefits of structural holes for innovation, not all evidence supports this contention—specifically, in a study of the international chemical industry, Ahuja (2000) finds that while direct collaborative ties increase firms' rates of patenting, structural holes had no positive impact, and perhaps a negative influence. This study reminds us that the meaning of different network measures and concepts, such as structural holes, depends on the kind of relationship being mapped: effective collaboration may require a different ego network than profitable brokerage.

SECTORAL AND SOCIETAL NETWORKS

We have described the causes and consequences of dyadic ties, networks among organizations and their organization set, and network forms of organization. We turn now to examine more macrolevels, including industry exchange networks and the character of the overall economy.

Industry and Sector Structure

In network terminology, an organization's relationships with suppliers contribute to its in-degree, and its ties to sellers define its out-degree. At an industry level, an input-output matrix in which the row-industry buys the amount in the cell from the column-industry can describe this web of exchanges. (These data can be downloaded from the Bureau of Economic Affairs at *http://www.bea.doc.gov/bea/dn2/i-o.htm*.) Ron Burt combined these data with information about how concentrated industries were (using the four-firm concentration ratio, which is the proportion of the industry's output accounted for by the four largest producers) to analyze an industry participant's structural autonomy, defined as the "ability to pursue and realize interests without constraint from other actors in the system" (Burt, 1982: 265). In essence, firms have high structural autonomy to the extent that their own industries are concentrated (they have few competitors/substitutes) and the industries of their buyers and suppliers are dispersed (that is, they have many competitors/substitutes). Organizations located in industries fitting this description have characteristically experienced higher profitability. For example, Sealed Air Corporation, maker of bubble wrap packaging materials, occupied such a spot in the late 1980s: its major supplies came from the commodity chemical industry (which, as the name implies, was quite competitive), its buyers included nearly every home and business in America that shipped fragile items (also a disconnected group posing little constraint on pricing), and its patents protected it from significant competition by firms within its industry. As a result, its margins (the difference between how much it cost to make its products and how much it could charge for them) were very, very high—on the order of 50 percent. Burt (1988) found the network structures of interindustry transactions to be highly stable over several decades, at least for aggregated industry sectors.

Network analysis can also be used to characterize relations among organizations and agencies attempting to influence policy decisions in the public sector. Laumann and Knoke (1987) compare the networks of "players" in the energy and the health care domains during the late 1970s and the types of issues that activated their involvement. Rather than seeing "the state" as a singular entity, potentially subject to elite rule, they conceive of the state as a collection of policy arenas in which private actors (such as businesses) that have strong, continuing interests interact with public agencies to shape policy. "Events" are triggered when concrete proposals for action come into the arena. Laumann and Knoke find that, at least in energy and health, no single issues were so central as to draw in all organizations within the field into the arena—organizations tended to participate in issues that affected them directly. There appeared to be few issues that mobilized everyone's interests. Rather, "issue publics" were identified, consisting of organizations concerned about the same sets of issues (although possibly with opposing interests).

Policy systems differ in the nature and extent of their order. Laumann and Knoke's study suggests that public agencies were more influential in the health policy than the energy networks in the United States. Moreover, "consensus about who matters appears to be much more systematically—indeed, almost

institutionally—organized in the health domain" (Laumann and Knoke 1987: 188). Energy was a relatively newer focus for national policy in the United States in the 1970s, and stable patterns of interaction and influence among organizational interests, both private and public, had not emerged at the time of the study.

This approach brings together both organization theory and network analysis in a useful synthesis for understanding how policy is made and how political interests are served. It also suggests an avenue for comparative research that examines the structural properties of policy networks. Thus, Song (2003) used network methods to contrast the relations among organizations and groups determining reading curricula across eight American states. Her study revealed quite divergent patterns of policy influence for varying actors, suggesting how it might happen that evolution is taught in almost all—but not quite all—states.

The Network Structure of the Economy

One can examine the network structure of an economy over time and compare it to the network structures of other economies, using comparable measures such as those described at the beginning of this chapter. Work of this sort is currently underway, but it requires a fairly massive scale of effort. In the meantime, we can sketch what is currently known.

The United States is undoubtedly the most studied economy among network researchers, and as we have described, both interlock and ownership networks have received considerable attention. The transformation of the American economy from an entrepreneurial to a corporate one at the end of the nineteenth century was accompanied by the elaboration of an interindustry interlock network, with the railroad, coal, and telegraph industries forming an early and enduring core among industrials. Ties across industries became increasingly dense but maintained a spoked wheel pattern, with core industries tightly interlinked and "periphery" industries tied to the core but not to each other (Roy, 1983). By the turn of the century, railroads were organized into relatively balkanized communities of interest linked by shared owners and directors (Roy and Bonacich, 1988). By the time the Clayton Act ruled out interlocks among competitors in 1914, banks—particularly so-called "money center" banks headquartered in major cities that cater to corporate clients—had become the dominant actors in the network, a position they held until the 1980s. Brandeis (1914) pointed out at the time that executives of three large New York banks—JP Morgan, National City (predecessor of Citibank), and First National (another Citibank predecessor that merged with National City in 1955)—held dozens of directorships on outside boards (seventy-two for JP Morgan, forty-nine for First National, forty-eight for National City). Remarkably, the same companies remained at the center of the network for seven decades, in spite of depression, bank regulation, and war (see Mintz and Schwartz, 1985; Mizruchi, 1982). Table 11-1 documents the surprising stability of the most central firms in the network between 1962 and 1982, and the relative upheaval in the subsequent two decades as the fortunes of commercial banks declined (Davis and Mizruchi, 1999).

TABLE 11-1 Ten Most Central Firms in the Interlock Network, 1962–2001

1962	*1982*	*2001*
JP Morgan [*56*]	AT&T [43]	*JP Morgan Chase* [*28*]
Chemical Bank [*51*]	*JP Morgan* [*48*]	Pfizer [26]
Chase Manhattan [*50*]	*Chase Manhattan* [*43*]	Sara Lee [28]

First National City Bank [*47*]	*Citicorp* [*43*]	Georgia Pacific [29]
Manufacturers Hanover [*43*]	IBM [38]	AMR [25]
Southern Pacific RR [38]	General Foods [31]	Dell Computer [19]
Ford Motor Co [34]	*Chemical NY* [*38*]	Verizon [28]
AT&T [31]	*Bankers Trust* [*39*]	3M [25]
Chrysler [28]	*Manufacturers Hanover* [*36*]	Allstate [24]
Bankers Trust [*41*]	Mobil [28]	Bellsouth [22]

Rankings are based on Bonacich's (1987) eigenvector measure of point centrality, in which a node is more central if the nodes it is connected to are also central. Banks are in italics.

Source: Davis, Yoo, and Baker (2003).

In Japan, keiretsu networks describe groupings of firms that can be both horizontal (in particular, the Big Six keiretsu of large firms reciprocally connected by cross-shareholdings) and vertical (organized around dominant lead firms, either banks or large industrials; Lincoln, Gerlach, and Takahashi [1992]). Group membership influences performance in surprising ways: while one might expect that group members are more profitable as a result of advantageous relationships with other group members, empirically group membership seems to make the average firm worse off. Lincoln and colleagues (1996) explain this by examining the dynamic performance effects of group membership: members that perform poorly subsequently return to normal levels of profitability more quickly than nonmembers, perhaps due to assistance from other group members, but unusually profitable firms also subsequently return to normal levels more quickly, a sort of group tax on performance.

In France, unlike the United States, the process for joining the economic elite has traditionally been fairly standardized, partly as a result of a long tradition of state ownership for the most substantial enterprises. Attendance at either the Ecole Nationale d'Administration (ENA) or perhaps the Ecole Polytechnique is virtually mandatory, as is a stint working in the Treasury Department. Optional, but highly recommended, is residence in the Sixteenth Arrondissement in Paris (Kadushin, 1995). The result of these preferential old school ties is a tightly centralized network (see Figure 11-4).

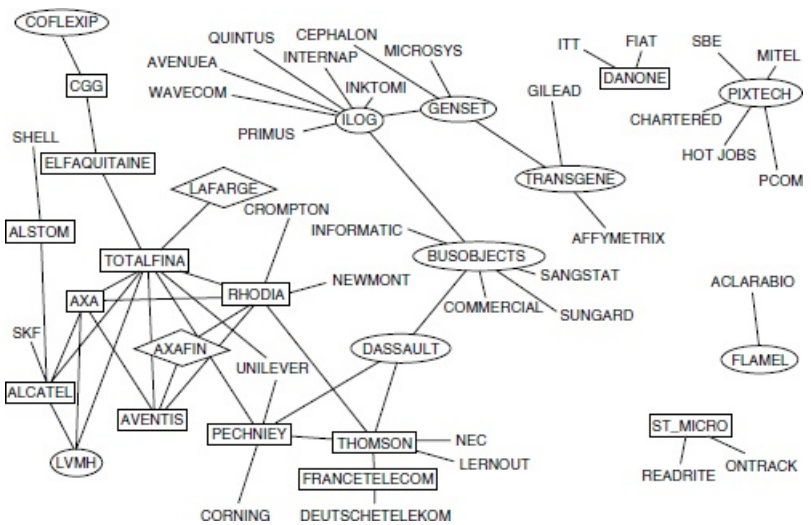

FIGURE 11-4 Shared Directors among French Firms Listed on U.S. Stock Markets. Rectangles are French firms listed on NYSE;ovals are French Nasdaq firms;diamonds are U.S. subsidiaries of French parents.

Source: Davis and Marquis (2005a).

In Germany, the three largest banks (Deutsche Bank, Dresdner Bank, and Commerzbank) traditionally held large ownership positions in major corporations, sometimes sufficient for control. The ownership of these three, as well as ownership of midsized firms by regional entities, traditionally knit the economy into relatively coherent groups. This situation, however, began to break down during the late 1990s, although ownership networks still reveal a relatively close-knit industrial economy relative to the United States (Kogut and Walker, 2001).

The economic importance of networks is revealed particularly starkly in situations of major transition, as in the case of post-socialist economies. Stark (1996) argues that in post-socialist Eastern Europe, "organizations and institutions [are rebuilt] not *on the ruins* but *with the ruins* of communism as they redeploy available resources in response to their immediate practical dilemmas." That is, rather than discarding all old institutions and starting anew, or mimicking the institutional structure of Western capitalist economies, Hungarian businesspeople recombined old and new elements into an emerging "East European capitalism" that did not belong squarely in either camp. Using data on the largest 220 firms in Hungary in 1993–1994 and fieldwork in a half-dozen enterprises, Stark found unexpected patterns in the transition. Semiautonomous firms were linked by keiretsu-like cross-ownership ties with hard-to-decode assets and liabilities; and government agencies continued to hold most shares of many firms.

As a final example, in China, the state actively encouraged the formation of groups like the chaebol in Korea and keiretsu in Japan in the 1980s in order to stimulate rapid, directed economic growth. In contrast to Japan, group membership enhanced organizational performance (Keister, 1998), and this effect grew stronger over time, as preferences for exchange with fellow group members (those they had worked with before) often trumped price in contracting relations (Keister, 2001). And in a provocative test of transaction cost analysis in a distinctive setting, Zhou and colleagues (2003) found that state-owned firms in China relied on social ties less than nonstate firms to find exchange partners, while riskier transactions induced more social interaction among contracting firms. This latter finding contrasts with prior work which suggested that social networks *enable* contracting; instead, it appears that in some instances contracting *induces* social networks.

Business Networks and Political Power

Political sociologists have long viewed networks, particularly among business elites, as providing an indicator of cohesion and potential political power (e.g., Mills, 1956). Along-standing debate between pluralists and elite theorists ran like this: elite theorists argued that the capitalist class (or the corporate elite, depending on the formulation) was able to act as a relatively coherent group when it came to politics, while pluralists argued that the issues that divided businesspeople were at least as great as those uniting them, so political outcomes were determined on an issue-by-issue basis according to different coalitions. Pluralists might point to issues like, say, steel tariffs (domestic steel manufacturers favor them; automakers who use steel oppose them), or environmental regulation (businesses with "clean" technologies favor it, particularly when it would be costly for their less-clean competitors, who oppose it). Elite theorists argue that on the big issues, business is relatively united, aided by common backgrounds (education at the same elite schools; membership in social clubs) and common organizations such as the Business Roundtable (an organization of roughly 200

CEOs that meets about policy matters).

The debate between pluralists and elitists is precisely the sort of "glass half full" topic that academics love: it is hard to imagine evidence that would actually sway either side, but many researchers have spent careers trying. Mills's intellectual heirs documented institutions thought to promote elite cohesion, such as secretive clubs (e.g., the Bohemian Grove, an all-male summer camp attended by California elites and the worthies they invite as guests, such as Ronald Reagan and Henry Kissinger) and shared board memberships (Domhoff, 1971). A primary piece of evidence for oligarchy, as Mills pointed out, was that the elites all seem to know each other—for those in positions of power, if not for the rest of us, it's a small world. On the other hand, analyses of the average geodesic in the corporate interlock network from 1982 to 1999 showed that this "small world" phenomenon (the fact that elites all seem to have friends in common) was unaffected by the declining fortunes of the banking industry and to turnover in the majority of the corporations that the elites oversee, suggesting that it is an intrinsic property of the elite network *as* a network, rather than the result of conspiracy (Davis, Yoo, and Baker, 2003).

Useem (1984) argued that service on multiple boards across different industries promoted a more cosmopolitan political worldview able to reconcile the divergent interests pointed to by pluralists, and he documented that such multiple directors (dubbed the "inner circle") were particularly likely to be involved with public policy organizations. Whether individual directors end up in the inner circle by design or by chance, it still has an influence on their outlook and on their access to power. Thus, Clawson and Neustadtl (1989) found that more central firms (those whose boards contain more multiple directors) made more PAC (political action committees) contributions to incumbents and fewer to conservatives in the 1980 elections, but they were more likely to be involved with conservative policy organizations, suggesting that PAC contributions are used to further corporate interests, but that policy organizations are used to pursue collective interests. And Vogus and Davis (2005) found that states whose corporations were overseen by densely connected elites were quicker to pass antitakeover laws favored by those corporations than less-connected states, indicating that a more cohesive state-level corporate elite is better able to get the laws it wants.

The seemingly irresolvable debate among pluralists and elitists experienced a sensible call for a cease-fire from Mark Mizruchi (1992). He argued that the appropriate question was not "Is the elite fragmented or unified?" but "*Under what conditions* are businesses unified?" His answer, drawing on organizational theory, found a number of mechanisms that led pairs of organizations to be more similar in their political activities (measured by the similarity of their portfolio of PAC contributions to candidates for office, testifying on the same side in hearings, and others). He found that interindustry constraint (described above in the discussion of Burt [1983]) increased the degree of similarity of PAC contributions made by firms in those industries, and that indirect interlocking through financial institutions (that is, having executives who served on the same bank boards) as well as common ownership by financials increased the similarity of PAC contributions. Whether these contributions influence policy in any direct way is still a matter for debate, as the profusion of subsequent studies on PAC contributions attests (Clawson, Neustadtl, and Weller, 1998; Mizruchi, 1992).

SUMMARY

Network analysis provides a way to visualize and analyze patterns of relationships among parts or "nodes," including flows of information, resources, energy, and authority. Organizations are characterized by formal and informal networks among members and units. Networks can describe ties among participants and ties among organizations. Social network analysts have developed an array of measures to quantify the position or importance of individual actors within networks and the shapes of the networks themselves. Network analysis can also be used to characterize technological, industry, and product space.

Researchers have studied several types of ties among organizations: who exchanges with whom, who shares members of the board of directors with whom, and who forms alliances with whom. In each case, one can examine why organizations choose particular partners, how long the relationship lasts, and what leads it to end. Examinations of board interlocks, created when organizations appoint as directors members of other boards, date back nearly a century to political concerns about the power of banks. Although banks had particularly well-connected boards for many decades, their position declined beginning in the 1980s. Companies generally recruit board members because of their expected qualities as directors and their accessibility, not as representatives of outside organizations; however, once on board, their external ties provide conduits useful for "business scan."

Alliances take many forms and have grown immensely in prevalence in recent years. Organizations form alliances for a variety of strategic reasons and in some cases alliances have proven to be a robust alternative to vertical integration. Alliance formation is linked to prior alliances: prior partners and "friends of friends" are more likely to be chosen than strangers. Research suggests that organizations that are well connected via alliances subsequently grew faster, formed more alliances, and were more likely to go public. For both interlock and alliance ties, the benefits to focal organizations often come as much from the appearance that these affiliations create as from the access to information and resources that they provide.

Networks are also used to describe a form of organization distinct from the functional, divisional, or matrix form. One typology defines network forms in terms of hybrid ties among organizational units—that is, relationships that stand between the arm's-length tie of buying an input on the market and the complete integration of making it internally. In a stable network, a lead firm maintains relatively long-term ties to outside partners upstream or downstream (e.g., shoe manufacturers in Asia, or retail distribution channels in the United States). Such forms are most common in mature industries with relatively long product cycles. In industries with short cycles, such as as fashion, movies, or high-technology manufacturing, a dynamic network is most common. This form consists of relatively temporary alliances of partners along a value chain formed for particular temporary productions (e.g., a movie, a product line, a construction project). Dynamic networks are often sited in industrial districts, that is, particular geographic areas with a high concentration of industry participants, such as Silicon Valley, Hollywood, or New York's garment district. Participants in dynamic networks often work with the same partners over and over again. A third type of network organization, the internal network, introduces marketlike interfaces into large organizations by encouraging units to buy and sell to each other at market prices and to look outside the organization for alternatives. As with the other forms, the intention is to keep each participant nimble by exposing it to market tests, while reaping the information and trust benefits of relatively close ties.

Societies can be analyzed in terms of the network structures of their economies and polities. Economies can be described by interindustry flows of goods and services, by ownership and other ties linking firms, and by linkages among banks and other organizations through shared directors. Analysts have also drawn on these tools to analyze political relations among businesses and governments. Cross-cultural comparisons of such networks are a particularly promising area of future research.

[1]In addition to its use as a descriptive and analytic tool, Moreno also regarded his methods as providing an important basis of social improvement and reform, supporting efforts to identify not simply existing, but also preferred social networks.

[2]The "oracle of Bacon" Web site at the University of Virginia Computer Science Department, http://www.cs.virginia.edu/oracle/, documents that Kevin Bacon has acted in films with 1,888 other actors during his career, and those 1,888 actors have appeared in films with another 159,399 actors—that is, more than 160,000 actors are within two degrees of Kevin Bacon. Moreover, of the more than 700,000 actors included in the Internal Movie Database, most are within three degrees of Kevin Bacon, a surprising fact that we explore below.

[3]Brandeis's concerns were shared by Congress and encoded into the Clayton Act of 1914, which made sharing directors among competitors illegal.

[4]We describe below research showing the importance of proximity for choice of friends by individuals.

[5]Note, however that profit centers within a single company sometimes set up market arrangements which allow each to decide whether or not they will acquire inputs from another center within the corporation or buy outside (Eccles and White, 1986). See the discussion of internal networks below.