1 Introduction

Social network studies entail the use of network representations to understand social phenomena. Social networks do not exist as such but only as concepts. This is illustrated by means of three example studies which also delineate the scope of this book.

Relations matter. You knew this, of course – Why else would you be interested in learning about social network analysis? The real questions are: How, where, when, and why do they matter? And, more pragmatically, how can you show that they do?

This book is organized along the process of an empirical study of social networks. It thus provides a guideline and orientation. While we concentrate on the things that are not treated in textbooks on empirical studies of population samples (i.e., non-relational studies), we still think that the book is largely self-contained.

So, what is the subject of a network study?

1.1 The Construction of Social Networks

It has become commonplace to refer to interacting or otherwise dependent entities as networks. The phenomena described as networks range from the social interactions of human beings and the flow of goods between countries to gene regulation and railroad infrastructures. What do these examples have in common that leads us to think we can model and analyze them in similar ways?

Some of the phenomena referred to as networks are real in the sense that their existence does not depend on our perspective. Online social

networking services, for example, are technology-enabled products. As such they have well-defined elements. A friending protocol specifies the sequences of actions that yield a link between two user accounts. The immanent meaning of such a link is unambiguous. We may refer to the web of linked accounts as a network or not, in any case, it is represented in the service provider's databases.

However, the social network of human beings who own accounts in the above system is an inferred, construed object. It has no independent existence and is thus always subject to interpretation. In these cases, the use of the term network is that of a model or metaphor; it does not denote an unambiguous object but a perspective.

As a metaphor the term "network" is very graphic, immediately evoking images of points and connecting line segments.[1] Metaphors are very useful for memorization and creative thinking. However, it is not necessarily obvious which aspects of a metaphor correspond to actual properties of that which is represented, and which aspects do not.

Another pitfall of metaphors and models alike is the use of similar representations for weakly related phenomena. By abstracting from the non-essential (with respect to a specific perspective), otherwise invalid commonalities and conclusions may emerge. To illustrate this point, consider (statistical) "distributions" as another example of a representation. If both the distribution of life-expectancy in the east of Austria and the household income in a suburb of Berlin are unimodal (i.e., have a single peak), does this imply that there is a relation between these two phenomena? We assume that you would not think so, but it appears to be much more tempting to speculate about such relations when two networks exhibit similar features because it is more easily forgotten that they are simplifying and homogenizing, reductionist representations.

The study of social networks is, hence, the study of a particular type of representation in social science contexts (Freeman 1989). Therefore, social networks are constructs and do not exist as such. They are representations, in which aspects of a social phenomenon – aspects that seem to be relevant in a specific context and for a specific purpose – are expressed in ways more amenable to scientific scrutiny.

Since there are no social networks per se, it is a linguistic simplification when we say that we are studying social networks. In fact we are studying social phenomena by means of network representations. This is carried

1 It appears that the term "social network" was coined in Barnes (1954), in which precisely this image is evoked.

out by gathering data about aspects of a phenomenon and organizing the data in a convenient form, by applying methods that produce additional, derived data, and translating these back to the realm of the phenomenon. Clearly, this is no different from other empirical investigations. What is distinct in network analysis, however, are the kinds of data and methods, and the reasoning that motivates network representations and justifies the interpretation of results.

1.2 Social Network Studies

We consider an empirical investigation a network study, if the underlying theory, the data, or both, focus on pair-wise relationships. Hence, the commonalities of network studies lie not so much in the phenomena under scrutiny but in the conceptual focus on relations. The following three examples illustrate this position and many other studies are outlined in grey boxes throughout this book.

1.2.1 The Community Question (Wellman 1979)

The growth of cities and the associated modernization processes constitute an important topic in urban sociology research. Community sociology-based urban research, in particular, often described processes of change as loss events: loss of familiarity, belonging, neighborhood, community, and small social networks. Within this tradition of community research, "urbanism" per se is equated with the development towards an "anonymous mass society" (cf. Wirth's classical essay of 1938).

In the course of urban modernization processes (for example, in the form of urban rehabilitation projects) and the associated residential mobility, the majority of affected residents experienced loss and grief reactions of varying intensity, which were explained in terms of the loss of spatial identity and the networks of relationships that had developed over generations (Fried 1963; and summary in Mühlich, Zinn, Kröning, and Mühlich-Klinger 1978).

The lament over "community lost," which has been a fundamental theme of social scientific urban research (cf. Wellman and Leighton 1979) since the 1930s, is combined here with an excessive romantic elevation of the patterns that have disappeared. As a counter thesis to the loss of

community the assumption emerged that neighborhood and family solidarity continues to exist in developed industrial-bureaucratic social systems. This position, which is known as the "saved argument," asserts that, due to its ongoing effectiveness, community solidarity lives on in the provision of support and sociability and the community demand for informal social control and environmentally-friendly integration into homogeneous residential areas and places of work. The saved argument attained a new orthodoxy in the 1960s through the publication of studies such as "Urban Village" (Gans 1962), Greer's (1962) theoretical development of post-war survey research, and Jacobs' (1961) comments on the vitality of the density of diverse city centers.

Whereas the culturally pessimistic line in the interpretation of urban processes of change laments the disintegration of a positive attitude to life – or "sense of community" in the sense used by Sarason (1974) and Glynn (1981) – an opposing pattern of interpretation sees the opportunity for and beginning of a "community liberated" in the disintegration of life forms dictated by tradition: The overcoming of cramped conditions and density, which contain both ties and social control, represents an important precondition for the individualization of persons. They gain the possibility of associating with people of their own choice, freeing themselves from rigid status allocations, and entering into and organizing relationships in accordance with their own voluntary needs. In the loose relationship ties that can be terminated at any time, scope for action arises that is characteristic of the urban subject. Most commentators, who participated in the "community" debate using the "lost," "saved," and "liberated" arguments viewed this as something akin to an alternative description of the "reality" of contemporary life, or the developmental succession from the pre-industrial saved community to the lost community, which was replaced, in turn, by the post-industrial liberated community (Wellman, Carrington, and Hall 1988: 135).

In the course of the many community analyses carried out, however, the fundamental structural concern about the question of community was often transformed into a search for local solidarity instead of one focusing on functioning primary relationships. It was assumed a priori here that a significant proportion of urban primary relationships are organized locally. Hence, Wellman (1979) suggests that the community question be studied from a network-analytic perspective. The benefit of the network perspective consists in the fact that it does not take supposed – local or kinship – solidarities as its starting point and does not aim primarily to

find and explain the persistence of feelings of solidarity. Instead, it is interested in presenting the structure of relationships and flow of activities so that the focus in the community debate is no longer on normative and spatial preferences but on the fundamental structural issues raised by the community question.

To this end, the question as to the effects of the differentiated social structure of the macro level on the significant social connections and relationships between individuals on the micro level is reformulated. For Wellman, social integration is not the community that is integrated via normative orientations but an integration achieved through the nature of the relationship structures. Forms of solidarity communities that can be closely defined spatially are no longer sought but, instead, strong relationships that are not characterized by spatial delineation but by their integrating function. Wellman et al. (1988) formulated the theoretical positions from community research in three theories – community lost, community saved, and community liberated – and applied the forms of the structural characteristics fostered as ideal types (see Figure 1) for an ego-centered network analysis and analyzed them in an empirical study on East York.

In 1968, Coates and Wellman surveyed 845 ego-centered networks in the Toronto neighborhood of East York (Wellman 1993: 426). A name generator was used for the purpose: "I'd like to ask you a few questions about the people outside your home that you feel closest to; these could be friends, neighbors or relatives." (Wellman 1979: 1209)

Of the named alteri, only the first six were recorded and taken into account for the remainder of the survey. Ego was then asked whether the named alteri had the same relationship with each other, i.e., whether they were close to each other. The role of the alteri for ego, the alteri's gender, the nature and frequency of contact between them (i.e., telephone, letter, or face-to-face), place of residence and distance between alter's and ego's residences, and the guaranteeing of everyday and emergency assistance from the alteri were also surveyed (Wellman 1979; Wellman, Carven, Whitaker, Stevens, Shorter, DuTroit, and Bakker 1973; Wellman and Hiscott 1985). An example is shown in Figure 2.

Wellmann found hardly any network structures in his East York study that could be clearly classified in accordance with the "lost" theory. The surveyed networks tended to correspond to the forms of the other two theories, however they could not easily be classified. Most of the networks displayed elements of both theories. In addition to these find-

community characteristics	lost	saved	liberated
size of networks	very small	very large	large
origins	friends, organizations	kin, neighborhood	friends, workplace
duration	short	long	mostly short
roles	acquaintances	kin, neighbors	friends, co-workers
socio-physical context	public, private	communal spaces	private spaces
residential separation	somewhat dispersed	local	highly dispersed
frequency of contact	low	high (much in person)	high (much phone use)
structural embeddedness	none	very high	high
network context	dyads	large group	small clusters
density	very low	very high	moderate overall, with dense clusters
cluster overlap	low	one big cluster,	low
number of network pieces (components+ isolates)	many small fragments and isolates	one big cluster, no isolates	several small clusters and isolates
cluster dominance	no	yes, by one	yes, by several
abundance of aid	low	high	moderate
variety of aid	low	high	high
articulation with large-scale social systems	little (companionship only)	defensive coping with demands companionship	ways of accessing resources, companionship
specialization	specialized ties	multistranded ties	specialized ties
reciprocity	low, only dyadic	high, communal	high, within circles

Figure 1: Ideal types of ego-centered networks according to Wellman, Carrington, and Hall (1988: 130–184).

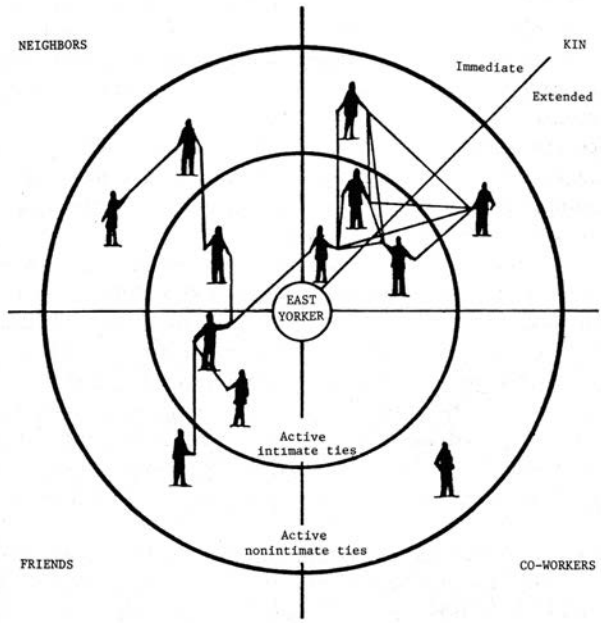

Figure 2: Personal network of an East Yorker (reproduced from Wellman and Berkowitz 1988: 27).

ings, what is interesting about Wellman's study is his reconceptualization of the community question, which was initially formulated in macro-sociological terms, in network-analytic terms with a view to making it applicable to a micro-sociological study (cf. Diaz-Bone 1997: 156). Wellman's use of ego-centered networks here reflects personal, experienceable circumstances of the micro level that can arise simultaneously in a society, which can be used in the description of the macro structure by generalizing them (cf. Diaz-Bone 1997: 156). With Wellman's help, this can be used to demonstrate the personal networks of important relationships (cf. Wellman 1979; Wellman et al. 1988).

This example clearly demonstrates how network analysis provides the basis for a discourse on the effects of societal modernization on the individual, the development of familiar life forms, and social relationships, and shows that, although one model or another can dominate in a social system, it is more likely that all three models are present in current reality, at least in part. This means that a personal community can consist

of a mixture of close-knit core clusters and a few lose-knit relationships, which also have connections with other groups and their resources.

1.2.2 Viral Marketing (Hill, Provost, and Volinsky 2006)

Hill et al. (2006) presents the results of a *network-based marketing* study. It analyzes the impact of a direct marketing campaign on different customer segments. In particular, the interest is in the importance of consumer networks for the adoption of a new product. In 2004, a telecommunications company conducted a direct-marketing campaign to sell a new "high tech" service to their customers. To obtain the best possible success rate by keeping the costs of the campaign as low as possible, the company decided to select a limited number of people as the target group of the marketing efforts. The company created 21 different segments based on demographic attributes and history with the costumers (e.g., loyalty). In addition to the segments of the company, the involved researchers added a second dimension to grouping the costumers—whether a person was directly connected through its telephone communications network to people that already used the particular new service or not. Consequently, the customers were separated for the analysis into four groups.

1. Traditionally selected customers that were not embedded in networks with existing users.
2. People that were selected twice via the traditional targeting of the company and based on the network connections to existing users.
3. People that were not part of the 21 segments but were selected by the company as, despite failing to provide demographic and historic evidence for becoming a customer of the new service, they had network connections to at least one existing user.
4. People that were not part of the marketing campaign at all but were connected to existing users.

Not very surprisingly, the second group had the highest take rates for the new service (1.25 percent). The following results were more unexpected—for the telecommunications company's marketing staff, at least. The take rate of the third group of people, which was not profiled as possible purchasers of the product but had connections to existing customers, was three times higher than that of the first group of traditionally selected people who were not connected to existing users of the service (0.83 percent and 0.28 percent). Moreover, the third group outperformed

every one of the 21 different segments that were selected on the basis of different demographic and historic attributes. Another impressive finding was made by the authors when they looked at the fourth group of non-targeted people who had connections with existing customers. The take rate for this group was 0.11 percent. Hill et al. (2006: 269) state that "although they were not even marketed to, their take rate is almost half that for the non-NN [non-network neighbor] targets." In addition, this is about ten times higher than the estimated 0.01 percent take rate for non-targeted people who were not connected to existing customers. In summary, Hill et al. (2006) presents convincing reasoning for the fact that when it comes to the proliferation of new products, connections to existing customers are significantly more important for successful adoption than any demographic attribute or any preceding relationships between company and customers.

1.2.3 Corporate Networks (Windolf 2006)

Until the last third of the 19th century, the family was a central institution in the coordination of transactions and mobilization of resources. Company management consisted predominantly of family members and the family often acted as lender of last resort. With the emergence of large companies, the familial organizational framework was exceeded. Complex transactions could no longer be controlled through familial relationships. Together with the large corporations, the network emerged as a new institution that facilitated the coordination of transactions, the supervision of management, and the social integration of the economic elite.

The network became a cross-company coordination instrument that increasingly superseded the family group. It largely freed itself from its ascriptive characteristics (family and ownership), and it became increasingly professionalized (professional supervisory board, management studies) and subject to regulation. The network constitutes an important element of this modernization process, in the course of which late 19th century capitalism was organized or rationalized.

The analyses of company networks in organized capitalism in Germany and the USA in the period from 1896 to 1938 focus on two functions which are fulfilled by the network and show that an opportunity structure was created through the network that made it possible to pursue different interests. These include the supervision function, on the one hand, and the regulation of competition, on the other.

Control Function

The relationship between the owners and managers in big corporations with thousands of shareholders is hampered by a principal-agent problem: managers have more information and competence. Hence the monitoring of managers became a central problem for corporations.

The function for controlling ownership was replaced by the social control in peer groups. The mutual presence of top managers in the supervisory bodies may be understood as a declaration that the company complies with business ethical standards and the shareholder is not being deceived.

The network provides social infrastructure, in the context of which the compliance with standards can be monitored. In this sense, the members produce a public good, the network's moral capital.

The company network is part of a comprehensive coordination and control system, to which large industrial concerns, universal banks and interest groups belong. Rudolf Hilferding coined the term "organized capitalism" to describe this institutional system. Organized capitalism is based on predictability, continuous profit yields, the bureaucratization of large companies, and the replacement of charismatic entrepreneurship by academically trained management.

Only when economic transactions are rationalized in this way can banks guarantee the reliable and continuous financing of large companies and capital-intensive mass production.

Whereas the banks in the USA provided loans, the banks in Germany were direct shareholders in companies.

Regulating the Competition

Companies that compete in a market make greater profits if they coordinate their behavior with each other.

Two different forms of coordination emerged in the USA and Germany, namely the trust and the cartel. The cartel is federal in structure: Member companies retain their legal and economic independence. Collective control prevents an individual company from gaining a monopoly. Price is often dictated by the weaker members of a group. The trust tends to lead to a centralized monopoly under uniform leadership. The member companies relinquish not only their economic independence but also their legal autonomy. Competition is not regulated in the trust but tends to be eliminated.

While developments in Germany were characterized by cartels, in the USA, increasing monopolization through the emergence of trusts led to anti-trust laws (Sherman Act).

The competition market is not a spontaneous, self-regulating institution; it must be repeatedly reconstructed through continuous control and state intervention.

In contrast, the model of regulated competition is regulated corporatistically. It does not propagate state control but the autonomous control of the market participants in an interest group. In this context, the company network is an institution that is complementary to the cartel. It strengthened the integration of the cartel members through their mutual presence on the supervisory boards. During the lifetime of a cartel agreement, conflicts of interests can be resolved and contractual adaptations be negotiated in the network.

The data records used in Windolf (2006) for Germany and the USA for the period from 1896 to 1938 contain a total of almost 40,000 relationships (interlocks), collected from a multitude of historical data sources.

The focus of interest here was the mandates of the supervisory boards in the different countries and the intersectoral networks, i.e., the question as to how strongly different economic sectors are networked. These data were compared either at national level over time (does the density increase or decrease?) or between the countries over time.

The data originate from a total survey of large companies in the year in question. The analyses relate only to this group of companies. The network border is defined relatively arbitrarily by the list of large companies. The network extends beyond the big companies, however, for example to small private banks and family enterprises. These relationships were not recorded in the study under discussion here. The analyses were not concentrated on the interests that were actually pursued by different actors in the network but on the opportunity structures that arise through the network. Hence the network offers the opportunity to stabilize the cooperation between rational egoists; it offers the chance to exercise control within a networked peer group and to sanction the contravention of business ethics principles. The more comprehensive the network and the greater the density, the greater the chances of achieving cooperation based on universal performance criteria in the network.

Certain assumptions about the structure of the network were extrapolated from the above-presented theoretical considerations. For example: If banks were an important supervisory body, it would have to be proven

that they assumed a central position in the network (actor degree centrality). And if the German banks had a strong interest in supervision due to their involvement in the granting of credit, they should be represented in (relatively) more companies as compared with the U.S. banks. The structural characteristics examined include multiple relationships, density, centrality and degree of the overall network and individual components.

The result of the analyses showed that the network in Germany developed into a coordination instrument that facilitated the cooperation between large companies. From 1928, fewer than ten per cent of the companies were isolated/marginal. This proportion was considerably higher in the USA (approximately 27 percent in 1928). From 1914 on, relationships per company and multiple relationships (redundancy) were considerably higher in Germany. The higher the redundancy, the greater the network density. The stronger centralization of German network can be interpreted as indicating higher supervision intensity. It was also shown that, in Germany, not only the banks had many contacts but also the industrial concerns. As opposed to this, in the USA, the finance companies were the most central actors. Hence, in Germany, not only the supervision of the banks but also the coordination of market processes were an important function of the network. The decline in the relationships in Germany between 1928 and 1938 can be explained by the legal regulation, on the one hand, and the liquidation of key Jewish companies/banks, on the other. In addition, it was possible to show that the intersectoral network in Germany was relatively high and increased continuously between 1896 and 1938. Therefore the network was used – in parallel to the cartels – as an instrument for the coordination of the market (regulated competition). The relatively high intersectoral networking in Germany between some economic sectors of heavy industry (coal, steel, chemistry, mechanical engineering) indicates that the network was used as a substitute for vertical integration or as a precursor of a vertical concern. The German banks were relatively strongly networked with the heavy industry sectors, but – in comparison to other economic sectors – they did not have the highest average network density. Before the First World War, the structure of intrasectoral/intersectoral networking between Germany and the USA was relatively similar. The two countries developed differently thereafter: Whereas intrasectoral networking declined in the USA, it increased in Germany.

In summary, the study shows that the networking between large corporations was an important element in the system of economic institu-

tions, which developed in late 19th century and provided a solution for specific problems associated with emerging organized capitalism. In the large corporations, the control of ownership was replaced by the alternating control of managers in the supervisory board or board of directors. The empirical structural analysis has shown that the network could be used as an efficient control instrument, particularly in Germany.

The network was also a supervision instrument for the banks, which took a considerable risk by granting investment loans, and associated their existence with the "long-term fate" of the industrial concern. In Germany, in particular, the network alleviated the problem of debtor opportunism. Until 1928, the proportion of large companies, in which a banker was represented on the supervisory board, increased to over 50 percent; this percentage was only slightly lower in the USA. The analysis also showed that the banks did not control the industrial concerns. The banks were lenders (Germany) or financial intermediaries (USA), and in this capacity forced the companies to adopt rational company management practices. The banks were important actors in the process of the rationalization of capitalism. In the age of early mass production and constantly increasing capital intensity (fixed costs), uncontrolled competition between the large companies was dysfunctional. The network provided an institutional framework, in which market processes could be coordinated and competition could be regulated.

1.3 Exercises

1. Collect definitions of "social network" and "social network analysis" from the literature. How are social networks, underlying theories, and means of analysis distinguished from other paradigms? How do these definitions apply to the above three example studies?
2. Network ties can both facilitate and constrain the actions of social actors. How do the interdependencies in social networks differ from those in markets or hierarchies as more restricted forms of organization?
3. Read the original references and compare at least two of the above example studies with respect to the following questions:
   - What is the overall research question?

- What precisely constitutes the networks of interest? Which data are collected and analyzed?
- Why are these networks relevant for the research question, i.e., what makes relationships between actors essential? How is this argued for?
- How does the particular structure, evolution, or functioning of networks enter the conclusions?

4. Write down at least twelve distinct relations that may exist between individuals, organizations, or animals. Try to classify them according to any characteristic. Discuss for which type of research question they may be relevant, and why monadic attribute data is insufficient for that purpose.