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DATA COLLECTION FOR MIXED METHOD APPROACHES IN SOCIAL NETWORK ANALYSIS

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3.1 Introduction

Many articles and handbooks describe how to collect data in social network research (Borgatti, Everett, & Johnson, 2018; Henning, Brandes, Pfeffer, & Mergel, 2012; Marsden, 2009; Prell, 2012; Scott, 2017; Wasserman & Faust, 1994), but only a few address issues related to mixed methods (MM) data collection (Edwards, 2010; Hollstein, 2014; Marsden, 2011). Using mixed methods in data collection in social network analysis (SNA) offers researchers an almost unlimited palette of possibilities to gather in-depth data on network structures and processes (Hollstein, 2011, 2014; Marsden, 2011). In this chapter, an overview is provided on how mixed method SNA (MMSNA) data collection has been used in recent research and how it might be used in future research projects. It should be noted that the examples show only a selection of possibilities for mixing, because the possibilities of mixing methods in data collection of MMSNA are almost limitless.

Using MM approaches for social network data collection, quantitative and qualitative approaches can be combined to gain a comprehensive understanding of the relations and processes taking place within networks (D'Angelo, Ryan, & Tubaro, 2016; Hollstein, 2011, 2014; Jack, 2010). Edwards (2010) describes it as providing an outsider view and an insider view of the network. Quantitative approaches producing numerical descriptions of structural network (e.g., nodes, connections) provide an outsider view on the network. Qualitative approaches provide descriptions, perceptions, and interpretations of relations (Hollstein, 2014) and enable an insider view on network practices. By supporting these approaches with visualizations, abstract relations within the network become more concrete and processes (e.g., change) become visible for the reader (Ryan & D'Angelo, 2018).

Greene, Caracelli, and Graham (1989) formulated five broad purposes for combining quantitative data and qualitative data: (1) triangulation to seek for consistency in the results, (2) complementarity to seek for elaboration of the results from one method with the results from another method, (3) development of a method by using the results from the other method, (4) initiation to seek for new perspectives by using results from different methods, and (5) expansion of the research by using different methods. The same purposes are applicable to research on social networks. Quantitative and qualitative approaches can be used during different stages in the collection process of network data (Bryman, 2006; Hollstein, 2014). Schoonenboom, Burke Johnson, and Froehlich (2018) recommended formulating detailed purposes of mixing before data collection. The detailed formulation sharpens the researcher's awareness of the research aim and how potential results can be integrated to answer the research question, or whether the results can be used for the next phase in the research design (e.g., the results of an interview study are used for developing a social network questionnaire).

3.2 Preliminary consideration to collect social network data

Before starting a data collection using MM, it is important to undertake preliminary considerations on the boundary of the network, the sampling (Prell, 2012), and the impact of missing data on the research outcome. These considerations strongly impact the choice, combination, and design of the different formats and instruments in SNA.

3.2.1 Boundary specification

A *boundary* refers to a set of actors that represents the population under study (Wasserman & Faust, 1994). Laumann, Marsden, and Prensky (1989) proposed two boundary-specification approaches for egocentric (i.e., individual) and sociocentric (whole) networks. First is the realist approach, which is applicable when the actors themselves define the group boundary in a naturally occurring social group. An example is when members of a gang experience collectively that they belong to the group (Sierra-Arevalo & Papachristos, 2015). Second is the nominalist approach, which is applicable when researchers define the social group. For example, Brouwer, Flache, Jansen, Hofman, and Steglich (2018) specified the boundary in learning communities research around a complete study program, because they were interested in relationship formation within and beyond learning communities within a study program. An MM approach during data collection can inform readers in more detail about the boundary by combing quantitative measures (numerical network measures) and qualitative measures (descriptive network measures).

3.2.2 Sampling

The process of sampling can either happen before the data collection, when researchers determine whom to include, or during data collecting (e.g., snowball sampling). Depending on the research question, Laumann et al. (1989) described three specification strategies for sampling in social network research: (1) the positional approach based on the characteristics of formal network membership, (2) the event-based approach based on participation in activities within a network, and (3) the relational approach based on social connectedness. In egocentric networks, ego is assumed to be the best informant for her/his individual network. In sociocentric networks, usually all relevant actors within a network are included in the sample. This implies that the number of all actors within the network is known. If this is not the case, researchers can use a snowball sampling approach in which data collections are initiated with by-then known actors (Prell, 2012). Based on the results, further actors are included as participants when they are nominated by previous ones (Henning et al., 2012). This is repeated until no new actors are nominated (Borgatti et al., 2018) or until researchers decide that enough material has been collected. An MM approach during sampling can support refection on the network to prevent missing data and enhance the reliability (Edwards, 2010). No explicit standards are defined for sample sizes in social network research because they strongly rely on the model assumed for network measurements (Krivitsky & Kolaczyk, 2015).

3.2.3 Missing data

The problem of missing data is particularly serious in social network research. It influences the study outcomes if important relations are not included in a network study (van der Hulst, 2011). The problem of missing data can occur when participants refuse to answer (non-response) because of privacy issues (Borgatti et al., 2018; Korir, Mittelmeier, & Rienties, 2020), when they drop out because of too many questions or when participants do not remember relationships correctly (An, 2011; Henning et al., 2012). To prevent missing data due to non-response, participants should be informed about confidential treatment of social network data. An inappropriate boundary specification or restricting the number of actors in a fixed-choice approach might be other causes for missing data (Kossinets, 2006). MM approaches may be a solution and prevention strategy to the occurrence of missing data, when the same information is collected parallel in two different datasets (Bernardi, Keim, & Klärner, 2014; Froehlich, 2020). Combining quantitative approaches (e.g., questionnaires) with qualitative approaches (e.g., interviews) and with visualizations can trigger a deeper reflection on the network, and thus mitigate the occurrence of missing data (Hollstein, 2011).

3.3 Appling data collection in MMSNA

Sociocentric and egocentric network data can be collected during three processes: name generating, name interpreting (Burt, 1984; Marsden, 2009), and name interrelating (Borgatti et al., 2018) (for examples, see Table 3.1). Depending on the research interest and the instrument design, these processes can be used step-by-step

TABLE 3.1 Examples for name generating, name interpreting, and name inter-relating

Name generating	Who are the actors in your network?
Name interpreting	Do the best guess of the age of the five aforementioned persons.
Name inter-relating	How well do these five persons know each other?

or simultaneously (Hollstein, 2014). Depending on the research aim (Wald, 2014), MM can be used in three ways during these processes: (1) qualitative approaches to inform about quantitative data, (2) quantitative approaches to inform about qualitative data, and (3) an integrated mix of quantitative and qualitative approaches (Edwards, 2010). In MMSNA, sociocentric and egocentric data can be collected by different combinations of questionnaires, interviews, observations, and archival documents. During data collection, researchers can use visualizations as supplemental material, which emphasizes both structure and processes of the network at the same time (D'Angelo et al., 2016). It should be noted that visualization can be produced before the actual data collection (if researchers already know the actors in the network), during the data collection process, or as a result of the data collection.

3.3.1 Name generating

Name generating means the collection of actors who are relevant for the network (Marsden, 2009) with surveys, interviews, network mapping, archival documents, and/or observations. Based on name generating, subsequent name interpreting and name inter-relating can be implemented (Prell, 2012). Researchers can use name generators for egocentric networks (Henning et al., 2012; Marsden, 2009); in sociocentric networks, for example closed- versus open-ended rosters can be developed during name generating (Borgatti et al., 2018). If relevant actors are known before the actual data collection, for example name lists (e.g., roster) and/or visualizations can be produced as starting material for name interpreting (Section 3.3.2) and inter-relating (Section 3.3.3). Which and how many names are collected depends on the research aim and the decisions on boundary and sample.

To ensure anonymity for the actors when publishing results, nicknames or initials can be used (Halgin & Borgatti, 2012; Marsden, 2009). For some research questions, name generating can be related to positions or resources actors provide within the network (Henning et al., 2012). Position generating indicates whether actors relate in certain social positions (e.g., low- or high-status occupations: Chua, Madej, & Wellman, 2011). Resource generating indicates whether actors relate with certain possessions or capabilities to each other (van der Gaag & Snijders, 2005).

Researchers can decide for a free choice or a fixed choice approach for generating names (Prell, 2012). In a free choice approach, the number of nominations is unlimited. For example, Van Waes, de Maeyer, Moolenaar, van Petegem, and van den Bossche (2017) were interested in how to strengthen teaching networks in a professional development program. Therefore, they asked their participants in a

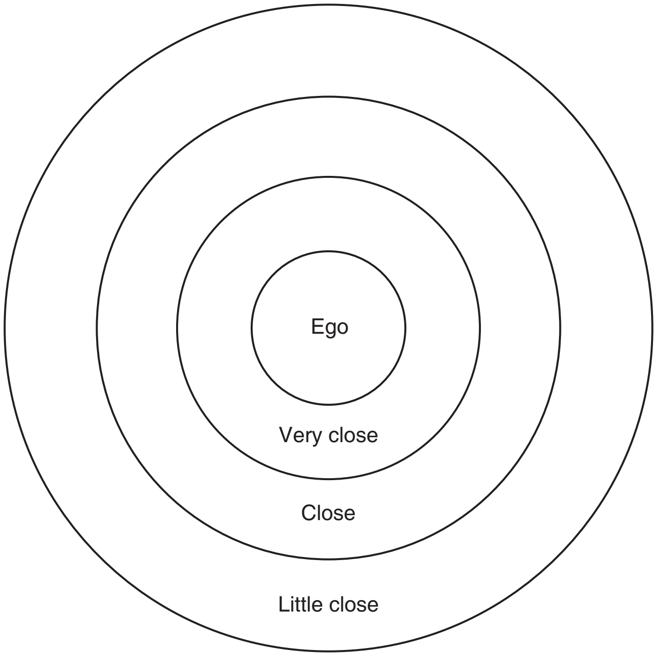

FIGURE 3.1 Example of a concentric circle map

combination of survey and network mapping approaches to provide the names of all the people they communicate about their instructional practice. The names were written on sticky notes and captured on a concentric circle map (see Figure 3.1). This allowed participants to define their own boundary and relations outside the program could be identified.

In a fixed-choice approach, a specific number of nominations is predefined (Wasserman & Faust, 1994). For example, Cachia and Maya Jariego (2018) were interested in mobility types, transnational ties, and personal networks in immigrant communities. For generating actor names, they used multiple name generators in a questionnaire format and restricted the number of nominations to 30 actors. Limiting the number of nominations enabled researchers to administer a follow-up interview combined with a network visualization.

Interviews can be combined with other instruments for name generating. They provide researchers with the possibility to ask more detailed questions. They are often used when processes of name generating, interpreting, and interrelating should happen simultaneously. Bilecen and Cardona (2018) were interested in the support transnational brokers provide and collected egocentric network data from migrant networks in Germany. They used a concentric map as visualization tool to capture the names immediately for further questions. Using the interview allowed them to directly interact with the participants and to support during a quantitative network mapping approach indicating, for example, transnational communications.

Using archival documents, names, or initials for actors can be derived directly from those documents (e.g., letters, online discussion forums) (Prell, 2012; Rienties, 2020). This allows researchers to obtain data which are in principle observable but not accessible for researchers (Henning et al., 2012). Gašević, Joksimović, Eagan, and Williamson Shaffer (2019) were interested in combining social and cognitive perspectives of collaborative learning. They derived their network data from a discussion forum for further analysis. To obtain a more accurate dataset, they also used additional survey data. Names can also be generated in combination with questionnaires or interviews (or both) when researchers have the feeling that the dataset is incomplete, inconsistent, or inaccurate. Whelan, Teigland, Vaast, and Butler (2016) suggested an MM approach to analyze massive digital datasets in the combination with quantitative or qualitative approaches. The mix of data can enrich the dataset and provide a deeper understanding of the network (Hollstein, 2014).

The use of observations is increasingly found in blended and online settings to study interactions (Rienties, 2020). In an early stage of a study, observations can help researchers to gain access to particular groups or to identify important actors (Hollstein, 2011). Wissink and Mazzucato (2018) were interested in changes within migrants' networks, whereby they used a field study for sampling and a mix of observations, interviews, and questionnaires to gather network data. An in-depth interview used multiple name generators to collect actors based on different kinds of support (e.g., emotional, financial) they provide. This approach allowed the researchers to reduce measurement and interpretation error.

3.3.2 Name interpreting

Name interpreting is used to generate attributional data of actors (Marsden, 2009, 2011; Prell, 2012) with surveys, interviews, visualizations, archival documents, and/or observations. Name interpreting may refer to quantitative data of personal background characteristics (e.g., age, gender), frequency of contact, or level of intimacy (Chua et al., 2011), but also qualitative data which provide insights in the composition, structure, and processes of the network (Hollstein, 2011, 2014; Marsden, 2009, 2011).

In social network research closed-ended questions are often used to generate quantitative network measures, such as when the participant has to respond to predetermined answer options like a Likert response scale (Borgatti et al., 2018, Prell, 2012). Therefore, rating versus complete rankings can be used (Wasserman & Faust, 1994). Rating means that participants rate or score each of the persons on the list on certain criteria (see Table 3.2). In a complete ranking all connections are ordered relative to each other, for example based on frequency of meeting (Volker, Flap, & Mollenhorst, 2013; Wasserman & Faust, 1994). However, ranking or ordering nominations is time-consuming, because it is difficult to distinguish between the contacts (Volker et al., 2013).

These quantitative approaches can be complemented by qualitative approaches which enable a participant to provide reasons or descriptions on the raking scores.

TABLE 3.2 I ask this fellow student (name) for help when I don't understand the study material

	Strongly disagree	*Largely disagree*	*Neutral*	*Largely agree*	*Strongly agree*
Jan	x				
Piet		x			
Klaas				x	
Marie			x		
. . .					

Therefore, open-ended questions are used (Hollstein, 2011). The answer options are not predetermined, which allows participants to reply more descriptively. For example, if researchers are interested in friendship support, quantitative approaches can inform about such things as, "How long has this person been a friend?" and qualitative approaches about such things as, "Why is this person a friend?" (Fischer, 1982; Wasserman & Faust, 1994). Rienties and Hosein (2015) were interested in the formal and informal learning in an academic development program. During the name interpretation process first quantitative data on frequency of contact or the type of relation was produced with a closed-ended approach. In a second step, a qualitative reflection exercise was established with an open-ended approach. With the support of visualizations, the participants were asked to reflect first individually and in group settings on their networks about how informal and formal learning were supported. This process is a mix of name interpreting and inter-relating. By this approach the researchers were enabled to triangulate the data. The quantitative data made the relations measurable, and visualizations for readers were provided for an outsider view of the network. The qualitative data on the relations provided an insider view on the processes within the network. By these three complementing approaches, the researchers were able to produce a rich dataset on complex relationships during the academic development program.

For name interpretation, questionnaires, interviews, or a combination of both, can be used. Visualizations can also be provided or can be produced during the process. Cachia and Maya Jariego (2018) used a combination of face-to-face interviews, questionnaires, and network mappings for name interpreting. The face-to-face interviews and the network maps were used to generate an adjacency matrix interactively for name inter-relating. The questionnaire was used to collect sociodemographic data of the actors. These data were then added to the network map. The two phases of data collection allowed the researchers to use various name interpreters (e.g., nationality, duration of tie, and type of relation). Van Waes et al. (2017) used questionnaires, based on their network mapping approach, which combined name interpreting and name inter-relating. Survey questions were used to indicate the attributes and relational ties to gather data on the composition and content of the network.

Observations can be used for name interpreting and for that can be combined with questionnaires or interviews. In their MM study, Wissink and Mazzucato (2018) used observations to get first impressions of attributes actors provide. In a second step, they used semi-structured interviews to obtain attributional information from the actors. This approach allowed the researchers to collect data that relied on both perceptions, their own and those of the relevant network actors.

Using archival documents, in some cases name interpreting can be part of the analysis, depending on the content of the document (Borgatti et al., 2018). Documents can contain both quantitative and qualitative data of actor attributes. If the content of the documents does not provide enough information, a combination with questionnaires or interviews might be a solution for name interpretation, if the individuals are approachable, which could provide this information. Rienties, Johan, and Jindal-Snape (2015) were interested in bridge builders in cross-cultural learning of international and host students. Because the visualization of interaction patterns between 81 students from 21 countries was too difficult to interpret for readers (Rienties, Hernández Nanclares, Jindal-Snape, & Alcott, 2013), they clustered the nationalities based on GLOBE study (House, Hanges, Javidan, Dorfman, & Gupta, 2004) and embedded a case study to examine characteristics of each single individual. Based on these findings, they were able to select five students functioning as bridge builders across different GLOBE cultures for a next case study. This enabled them to collect in-depth data about processes, why these processes were happening, and about the effects of these processes.

3.3.3 Name inter-relating

Name inter-relating describes the process of examining relational ties between actors (Borgatti et al., 2018). Questionnaires, interviews, or a combination both can be used to gather quantitative data (e.g., Likert response scales) or qualitative data (e.g., description of relations) during the inter-relation. Roster or free recall techniques can be used to indicate ties (Marsden, 2011; Prell, 2012, Scott, 2017). In a roster, a complete list of each actor within the network is compiled based on sampling or name generating, for example all classroom members. This allows the participants to indicate relevant relations within the network and to minimize false indications due to forgetting (Butts, 2008). If the list of actors is too long, a free recall format can be used. Here, the participant indicates particular relational ties by mentioning the relevant actors for this relation. During this process a list can be provided based on the data from the name generators. Brouwer et al. (2018) investigated peer network formation in learning communities and combined questionnaires with a roster format with free recall. The learning community members were automatically listed when the student entered his or her ID number in the online survey. In the free recall the student could add names with whom they had had contact outside their learning community, but within the faculty under investigation (Rienties, 2020). A roster format is easy to fill out and provides insight into non-selection, which is only possible if a complete list of actors is provided

(Veenstra & Steglich, 2012). Based on non-selection, qualitative approaches could provide insight into why certain actors were not nominated. Visualizations of network maps can be used to support the process of name inter-relating. Van Waes et al. (2017) used an interactive mapping approach to allow participants to immediately indicate lost, steady, or new ties in the network. This allowed the researchers and the participants to visually experience changes in the network.

Interviews can be used if the research aims to collect rather descriptive data about relations between actors (Hollstein, 2011) to enable an insider view of the network (Edwards, 2010). Based on the data collected in quantitative approaches several social network metrics can be calculated (e.g., centrality, density, reciprocity). For example, Van Waes et al. (2016) used interviews to investigate university teacher networks in different stages of professional development. Qualitative name interpreting and inter-relating questions were used to gain insight into the exchange (e.g., storytelling, helping) and the value creation through the interaction. The interviews generated in-depth insight into the constellation of interactions among teachers. Marineau, Labianca, Brass, Borgatti, and Vecchi (2018) examined the relationship between individuals' power and their perceptual accuracy of social network relationships. A three-step approach was used with (1) semi-structured interviews, (2) an online survey, and (3) provision of a complete map in a matrix design, based on the participants' perception of relational ties regarding cognitive social structure within the network. The participants were asked to indicate the relationships among co-workers by filling in the cells that they perceived as relevant.

Observations allow researchers to directly observe relational interactions (Marsden, 2011; Scott, 2017). A content analysis of the interaction patterns allows researchers to describe the relations between actors. Bianchi, Casnici, and Squazzoni (2018) were interested in social support and trust in co-working spaces. They used a qualitative fieldwork approach to collect data on the interaction within co-working spaces. They combined observations with interviews of different important actors in the network, generating information about the organizational and contextual structure of the network. Based on their findings from the observations and from the interviews, visualizations were produced displaying the structure of company co-membership among the actors. Dingyloudi and Strijbos (2018) examined personal and academic networks as well as peer feedback to identify centrality patterns. They combined social network questionnaires to collect data on complete networks with observational video data to identify interactions involving peer feedback. This approach allowed them to observe interaction directly without the need to rely on self-reported data.

Archival documents can contain descriptions of relations and allow researchers to draw conclusions about relational ties between actors (Prell, 2012). Questionnaires or interviews can be used as additional instruments to collect data for name relating, if the document does not contain enough information. Gašević et al. (2019) used archival data derived from discussion forms to inter-relate the actors in the network by extracting a directed-weight graph to represent their interaction.

At a dyadic level they built relational ties of the actors based on selective mixing, reciprocity, popularity, and expansiveness.

3.4 Guidelines for MMSNA

Researchers who intend to apply an MMSNA design should be aware of the advantages and disadvantages of combining and integrating different data formats. MMSNA can be beneficial in the sense that the quality of the data is enhanced, and it allows researchers to get a deeper and more explanatory understanding of social phenomena (Hollstein, 2011, 2014). It combines the strengths of quantitative and qualitative methods, allowing for objective and comprehensive triangulation on relational data (Hollstein, 2014; Scott, 2017; Wald, 2014), which enhances the explanatory power and the generalizability of the data (Hollstein, 2011). By combining qualitative and quantitative approaches, structural and relational data can be explained, and the nature of relations can be captured thoroughly (Bryman, 2006; Edwards, 2010), thus reducing measurement and interpretation error (Wissik & Mazzucato, 2018). Using MMSNA provides researchers various possibilities to address different research questions on, for example, support, exchange, or change. Compared to mono-method designs, one of the main drawbacks is that it is more time-consuming for the researchers as well as for the participants to collect different data. It is also more ambitious in terms of required researcher skills (Hollstein,

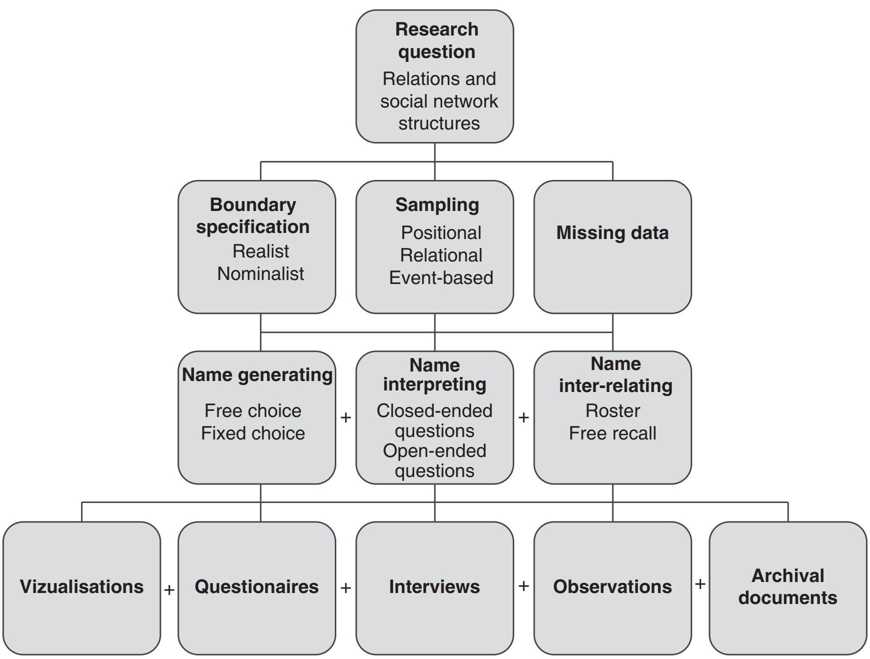

FIGURE 3.2 Schematic guideline for a mixed method data collection process

2014). Therefore, MMSNA should be only applied for complex research questions, and/or for specific detailed formulated purposes (Hollstein, 2014; Schoonenboom et al., 2018; Wald, 2014).

Before the data collection starts, researchers should be aware of the research aim (Bryman, 2006; Wald, 2014), choose an appropriate sample, set suitable boundaries, and consider missing data. The choice of the instrument – or combinations of instruments – strongly depends on these decisions. For name generating, name interpreting, and name inter-relating, questionnaires, interviews, observations, and archival data can be combined in different ways. This allows researchers to collect appropriate data types for various research questions. Combing these instruments with interactive mapping or visualizations supports a deeper reflection on the network, prevents the occurrence of missing data (Hollstein, 2011), and enables the participants to immediately indicate relational change in the network (van Waes et al., 2017).

As discussed in this chapter, all formats have pros and cons, and researchers should decide during the planning stage of the data collection how the research question can best possibly be addressed based on a cost–benefit analysis. Figure 3.2 depicts a schematic guideline that summarizes this chapter and may serve as a guidance for researchers who want to collect data for MM social network research.

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