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# Mixed-Method Approaches to Social Network Analysis

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**Abstract**

Social Network Analysis (SNA) has received growing attention in methodological debates in the social sciences. Recent mathematical developments and user-friendly computer programmes for visualising and measuring networks have led to significant advances in quantitative SNA. Amidst these developments, however, there have been calls for the revival of qualitative approaches to social networks, not necessarily to supplant quantitative methods, but to complement them. Quantitative approaches map and measure networks by simplifying social relations into numerical data, where ties are either absent or present. They therefore bracket out questions of crucial importance to understanding the kinds of human interaction networks studied by social scientists. Qualitative approaches, on the other hand, enable analysts to consider issues relating to the construction, reproduction, variability and dynamics of complex social ties.

This paper considers the arguments for adopting a mixed-method approach to network analysis, firstly as they arise out of the existing research literature, and secondly, as they have been highlighted in explicit theoretical debates about combining quantitative and qualitative data and analysis. By unpacking the different ways in which researchers have combined quantitative and qualitative methods in network projects it also seeks to provide some guidance for others on 'how to' mix methods in SNA. In particular, it reviews literature in which quantitative SNA has been combined with interviews, ethnography and historical archival research and considers the benefits of these strategies. On a theoretical note, the paper considers suggestions that mixing quantitative and qualitative approaches can enable researchers to explore the structure (or form) of networks from an 'outsider's' view, and the content and processes of networks from an 'insider's' view. It also refers to recent discussions which suggest that SNA offers a particular opportunity for mixing methods because networks are *both* structure and process *at the same time*, and therefore evade simple categorisation as either quantitative or qualitative phenomena.

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## Introduction

Social Network Analysis (SNA) has developed as an approach for studying 'social relations' rather than 'individual attributes' (Burt 1978). The 'social network' at the focus of inquiry consists of a set of actors and a set of relations between them (Wasserman and Faust 1994). Quantitatively-driven SNA generates numerical data on social relations by using quantitative methods like surveys, and maps and measures the structural properties of social networks using sophisticated quantitative techniques (Carrington et al. 2005). Despite the current dominance of this approach, there is also a tradition of qualitatively-driven SNA (see Heath et al. 2009), which builds upon early anthropological network studies (Barnes 1954; Bott 1957; Mitchell 1969) and generates observational, narrative, and visual data on social relations by using ethnography (Trotter 1999), in-depth interviews (Pahl and Spencer 2004), and participatory mapping techniques (Emmel 2008).

SNA, particularly as a set of formal analytic tools, has received growing attention in recent years with a proliferation of research publications and activity across a variety of fields from sociology, anthropology, economics and politics, to psychology, business, mathematics and physics (Freeman 2004). In methodological debates in the social sciences, this attention is beginning to coalesce around the desirability of combining qualitative with quantitative approaches to networks at the level of both data and analysis. Debates over mixed-method approaches to SNA have found their most explicit statement in the business literature, partly due to the dominance of quantitative approaches (Monsted 1995; Coviello 2005; Jack 2010). Also as a reaction to this domination, theoretically driven calls for mixing methods are emerging from within sociology (Emirbayer and Goodwin 1994; Mische 2003; Crossley 2009a) and anthropology (Riles 2001; Knox et al. 2006). Running alongside and even pre-dating these explicit debates, is a further body of research literature in which quantitative network analysis has been beneficially combined with various qualitative methods of data collection/analysis, ranging from interviews and ethnographies, to historical archival research, and conversation analysis. It is the purpose of this paper to touch upon both these aspects by reviewing the explicit, theoretically driven debates for mixing methods in SNA, and by discussing the different practical ways in which this has been achieved in existing research projects.

The issue of combining quantitative and qualitative approaches to SNA is of particular interest in the wider context of debates over mixing methods in the social sciences. This is because some network analysts have argued not only that it is *desirable* to combine quantitative and qualitative methods, but that SNA represents a specific *opportunity* to mix

methods because of its dual interest in both the 'structure' or 'form' of social relations (i.e. the 'outsider' view of the network), and the interactional 'processes' which generate these structures, and have to be understood by exploring the 'content' and perception of the network (i.e. the 'insider' view of the network). SNA also holds particular interest because of its specific history as an interdisciplinary field. It developed both from formal mathematical advancements in sociometry and graph theory (Moreno 1934), and from early ethnographic studies of the structures of kinship and interpersonal relations carried out by anthropologists (Barnes 1954; Bott 1957; Mitchell 1969).[1] SNA therefore has its roots in both quantitative and qualitative fields of inquiry. Despite this, however, SNA has largely been popularised since the 1970s via a growth in mathematical techniques for mapping and visualising social relations, and importantly, the development of user-friendly computer packages for handling network data and analysis, for example, Pajek (de Nooy et al. 2005) and UCINET (Borgatti, Everett and Freeman 2002)[2]. Meanwhile, qualitative research on social networks, which has been conducted within topics ranging from community studies to social capital, has been less consciously self-styled as 'qualitative social network analysis' (Heath et al. 2009, 646). There has therefore been a tendency for mainstream discussion of 'SNA' to have an implicit orientation to the more dominant quantitative tradition.

This is compounded by the mathematical and software developments that have continued to flourish in recent years, and have arguably left qualitative network analysis at the margins, trying to fight its way back in via arguments about the importance of culture, narrative, content, and context to the ways in which networks, particularly those constituted by human interaction, operate and can be understood (Emirbayer and Goodwin 1994; Mische and White 1998; Mische 2003; Crow 2004; McLean 2007; Clark 2007; Emmel and Clark 2009; Crossley 2009a). Calls for the extension of qualitative approaches to network analysis do not necessary wish to supplant formal approaches, however, but to complement them (Mische 2003, Crossley 2009a; Emmel and Clark 2009; Heath et al. 2009). Formal approaches remain valuable because they offer what qualitative approaches cannot: they are able to map and measure certain aspects of social relations in a systematic and precise fashion. However, qualitative approaches can also offer what quantitative approaches cannot: they can add an awareness of process, change, content and context. The mapping and measuring of social relations necessarily reduces them to binary categories (i.e. ties are either present or absent), and questions as to the quality and/or strength of relations cannot be

[1] See Scott (2000) for a historical overview of SNA.
[2] See 'web resources', p.30.

adequately captured by adding extra numerical details (like, for instance, recording the frequency of contacts in data matrices) (Peay 1980). Network diagrams also produce static 'snapshots' of ties, which are anything but stable over time (Monsted 1995, 206). Despite advances in the statistical analyses of network dynamics over time (Snijders 2001), issues pertaining to the content, meaning and timing of ties thus remain, and these questions are often those of crucial importance to understanding the kind of human interaction networks studied by social scientists. Qualitative approaches are forwarded therefore as a complement, and an essential complement at that, to quantitative work. A mixed-method approach enables researchers to both map and measure network properties and to explore issues relating to the construction, reproduction, variability and dynamics of network ties, and crucially in most cases, the meaning that ties have for those involved. The ways in which quantitative and qualitative approaches have actually been combined in empirical research on social networks in the last decade, and the reasons given for combination are, however, extremely varied.

The paper consists of three main sections. In section one I introduce methodological approaches to SNA, looking at the different methods that have been employed in data collection and analysis. I outline the kind of methods used in qualitative SNA and give a non-technical introduction to formal SNA for those unfamiliar with the basic technique. In section two I review some of the existing research literature in which quantitative and qualitative approaches have been combined. I pinpoint three key ways in which researchers have mixed methods in empirical projects on social networks, providing some guidance on 'how to' mix methods in network research. In particular, I review projects which have combined formal network analysis with interviews, ethnography, and historical archival research, and consider the added-value of mixing methods. Section three returns to the explicit theoretical debates about combining methods in network analysis, and considers the argument that mixing methods enables researchers to study the 'inside' and 'the outside' of networks, but also, in line with recent arguments about the importance of narrative and culture, to turn social networks 'inside out' (Riles 2001; Knox et al. 2006).

**Section One: Methodological Approaches to Social Network Analysis**

Broadly speaking, social network analysis aims at producing and analysing 'relational' data. In the social sciences, this data pertains to social relations between actors (whether these are individuals, groups, or organisations). SNA focuses upon analysing sets of 'ties' (the 'lines') between actors (the 'nodes'). Formal SNA has developed a particular interest in the kinds of things that 'flow' through the network and the ways in which the (measurable) structural

properties of the network affect *how* they flow. Key topics of inquiry include, for example, the flow and exchange of resources, trade flows between countries, the flow of information and ideas, the diffusion of innovation in organisations, the flow of disease and influence, and the flow of social support. Qualitative SNA has been less interested in resource exchange and more interested in exploring the 'lived experience' of social networks (Emmel and Clark 2009, 2); what 'passes' through networks (Crow 2004); the spatial embedding of network ties (Clark 2007); and the consequences of network dynamics for inequality in social life (Heath et al. 2009). Qualitative SNA has, for example, extended early anthropological network concerns by pursuing research on communities, neighbourhoods, kinship and friendship (Young and Wilmott 1957; Trotter 1999; Pahl and Spencer 2004; Morrow 2004; Emmel and Clark 2009).

SNA either requires data on the 'whole network', in which case boundaries of the population of interest must be drawn, or upon 'personal networks', where all the ties of an individual 'ego' are recorded along with the ties between their 'alters'. These are called 'ego-networks' (see Bott 1957; Mitchell 1969; Fischer 1982; Wellman 1990, for classic research examples). Qualitative SNA has tended to focus upon personal networks rather than whole networks, raising important questions about how the boundaries of social networks can be drawn. In their study of personal networks and educational decision-making, Heath et al. (2009) argue for example that qualitative network research draws attention to the ways in which the networks we study are always 'permeable, partial and dynamic' (Heath et al. 2009, 645), and make a useful distinction between the 'shadow network' (which includes the alter-ties that they know were important to ego, but could not get first hand data about) and the 'achieved network' (which includes the alter-ties that they managed to interview) (Heath et al. 2009, 654). Formal SNA has also considered the question of network boundaries and has developed strategies to deal with the problem of 'missing data' (Kossinets 2006).

*Qualitative Methodologies*

Qualitative SNA has employed a number of strategies to generate and analyse relational data. Anthropological studies, such as those of the early Manchester School of Social Network Analysis, popularised the use of ethnography in social network research (Barnes 1954; Mitchell 1969; see also Trotter 1999). The work of Barnes (1954) was extended by Bott (1957) in her classic study of London families. Bott (1957) studied the social networks of couples and looked in particular at density and segregation in family networks. Ethnographic methods have also been employed in a recent study on 'networks, communities and

neighbourhoods' within the 'Connected Lives' project of the ESRC *Real Life Methods Node* (Emmel and Clark 2009). The study explored personal social networks in Leeds and the researchers adopted a range of qualitative methods to look at how social networks are experienced and how they are embedded in spatial and temporal contexts. Methods included participant observation; 'walking interviews' (where the participants were interviewed whilst leading the interviewer on a walk around their local area); diaries of communicative practices (see also, Seed 1990); and participatory visual mapping techniques. 'Participatory mapping' is employed within the context of an in-depth interview and is used as a 'name-generator' tool (i.e. as a way to compile the names of others in the network and discuss their significance). The participant is asked to freely create a visual map of their social network using pens and paper, and the interviewer uses this process to probe the ways in which the participant has chosen to represent their network, and their perception and experience of the network (Emmel 2008). Visual mapping techniques are useful because they enable 'participants to move from description of social practices, to their elaboration and theorisation' (Emmel and Clark 2009, 16). Qualitative uses of participatory mapping have also adopted the 'concentric circles' approach, where participants are asked to place contacts within different rings on a sheet of paper, with those closest to them at the centre (Pahl and Spencer 2004).

In-depth interviews with both egos and alters (with and without the aid of participatory maps) have also been used in qualitative network analysis. Heath et al. (2009) for example, started their research on the influence of social networks on educational decision-making with an interview sample of 16 egos and through them gained access to 107 interviews with alters. Through these interviews they collected rich narrative data on both egos and (a selection of) alters. Importantly, this method differs from other ego-network studies (such as name-generator questionnaires) in that it does not rely solely upon ego to provide information about alters but conducts interviews with alters as well. This in-depth qualitative approach helped the researchers to identify important network factors in educational decision-making, like the existence of shared frames of reference and expectations within families when talking about educational experiences (Heath et al. 2009).

Qualitative approaches therefore generate a range of narrative, observational and visual data on social networks. These data are then analysed qualitatively using content and thematic analysis, and by situating network data within wider contextual findings.

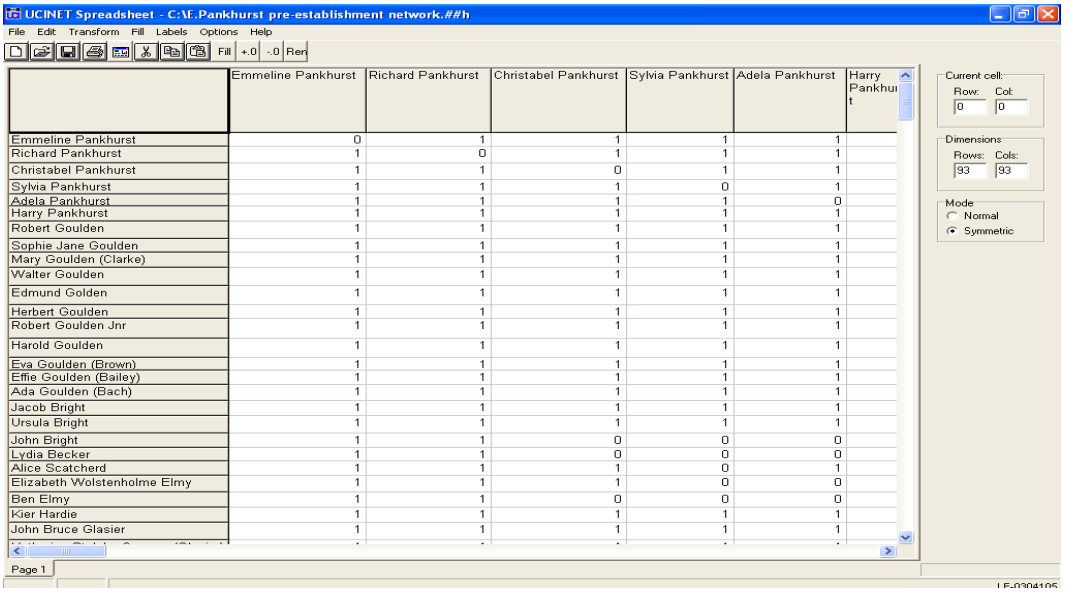
*Quantitative methodologies*

In formal SNA, relational data are predominantly collated using quantitative methods like name-generator surveys, which produce numerical data on the presence or absence of ties (and in some cases tie 'strength', such as frequency of contact). In Fischer's (1982) classic study of personal networks in California, for example, a mass survey was used to gather data on the ties of egos and their alters (see the 'methodological appendix' in Fischer 1982). This can be done by asking actors to list everyone who they know/is a friend/provides them with support etc, depending upon the research question. Wellman's (1979; 1990) studies of social support networks in East York, Toronto, also employed a survey to collect relational data, asking questions for example about the six people outside the home who participants felt 'closest' to (Wellman 1979, 1208-9).

Although less conventional, data for use in formal SNA can also be generated by qualitative methods like observation, interviews, and archival research, where narrative data are subsequently quantified (see Edwards and Crossley 2009). The quantification of relational data happens via an 'adjacency matrix', where ties between actors are recorded as present (1) or absent (0). Ties can be 'directed' (i.e. from actor x to actor y, but not necessarily vice versa), or undirected (i.e. reciprocal). These matrices can be constructed in excel spreadsheets, or in the spreadsheets contained within SNA software like UCINET. For purposes of illustration, figure 1 shows a data matrix relating to the personal network of the British Suffragette Emmeline Pankhurst (pre-1903), which was constructed in UCINET using historical sources as part of a wider project on suffragette networks[3]. It is also possible to input data into an 'incidence matrix', by recording, for example, actors by events. Ties are recorded as present (1) if an actor attended the specified event. This '2-mode' data can then be converted into '1-mode' data so as to link all the actors who attended the same event.

[3] The Suffragette Network Project (2009/10), Gemma Edwards, Nick Crossley, Rachel Stevenson and Ellen Harries, University of Manchester, UK.

**Figure 1: Example – UCINET data matrix for Emmeline Pankhurst's personal network pre-1903 (93 actors, undirected ties)**

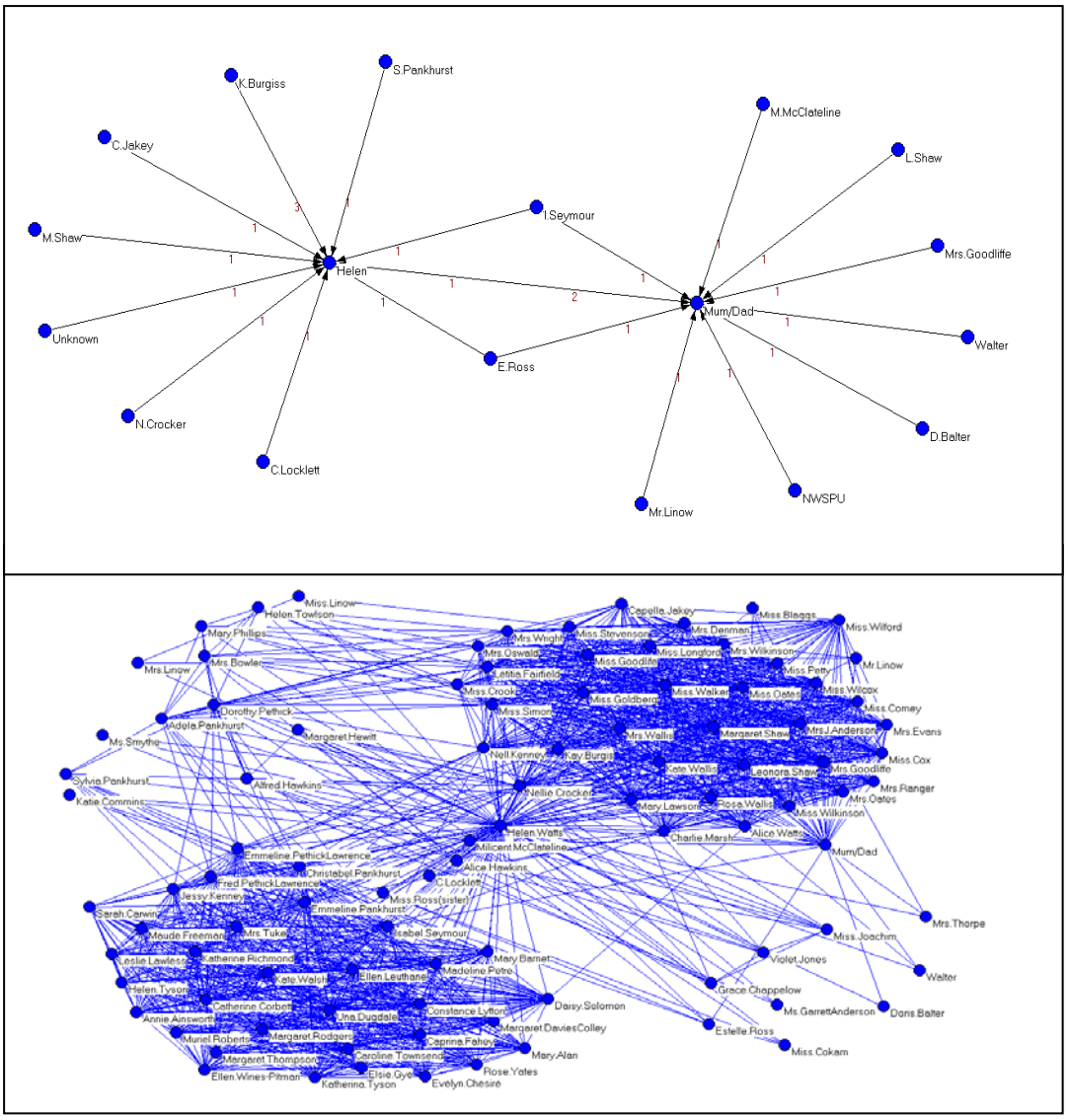



| | Emmeline Pankhurst | Richard Pankhurst | Christabel Pankhurst | Sylvia Pankhurst | Adela Pankhurst | Harry Pankhurst |
|---|---|---|---|---|---|---|
| Emmeline Pankhurst | 0 | 1 | 1 | 1 | 1 | |
| Richard Pankhurst | 1 | 0 | 1 | 1 | 1 | |
| Christabel Pankhurst | 1 | 1 | 0 | 1 | 1 | |
| Sylvia Pankhurst | 1 | 1 | 1 | 0 | 1 | |
| Adela Pankhurst | 1 | 1 | 1 | 1 | 0 | |
| Harry Pankhurst | 1 | 1 | 1 | 1 | 1 | |
| Robert Goulden | 1 | 1 | 1 | 1 | 1 | |
| Sophie Jane Goulden | 1 | 1 | 1 | 1 | 1 | |
| Mary Goulden (Clarke) | 1 | 1 | 1 | 1 | 1 | |
| Walter Goulden | 1 | 1 | 1 | 1 | 1 | |
| Edmund Golden | 1 | 1 | 1 | 1 | 1 | |
| Herbert Goulden | 1 | 1 | 1 | 1 | 1 | |
| Robert Goulden Jnr | 1 | 1 | 1 | 1 | 1 | |
| Harold Goulden | 1 | 1 | 1 | 1 | 1 | |
| Eva Goulden (Brown) | 1 | 1 | 1 | 1 | 1 | |
| Effie Goulden (Bailey) | 1 | 1 | 1 | 1 | 1 | |
| Ada Goulden (Bach) | 1 | 1 | 1 | 1 | 1 | |
| Jacob Bright | 1 | 1 | 1 | 1 | 1 | |
| Ursula Bright | 1 | 1 | 1 | 1 | 1 | |
| John Bright | 1 | 1 | 0 | 0 | 0 | |
| Lydia Becker | 1 | 1 | 0 | 0 | 0 | |
| Alice Scatcherd | 1 | 1 | 1 | 0 | 1 | |
| Elizabeth Wolstenholme Elmy | 1 | 1 | 1 | 0 | 0 | |
| Ben Elmy | 1 | 1 | 0 | 0 | 0 | |
| Kier Hardie | 1 | 1 | 1 | 1 | 1 | |
| John Bruce Glasier | 1 | 1 | 1 | 1 | 1 | |

**UCINET, Borgatti, Everett & Freeman 2002**

Visual network maps, also called 'sociograms', can be produced by visualising the data in the matrix. In contrast to qualitative SNA therefore, the visualisation of the network usually takes place after the data collection stage rather than during it (although see Hogan et al. 2007 for an instance where participatory mapping is used during interview and then converted into a data matrix for quantitative analysis). Figure 2 shows two sociograms; firstly, of the letter writing network of suffragette Helen Watts (18 nodes, directed ties and ties weighted by frequency of contact); and secondly, of the activist network of Helen Watts (92 nodes, undirected ties). Both of these sociograms were produced using Pajek (de Nooy et al. 2005).

**Figure 2: Example – Pajek sociograms: 1. Helen Watts' letter writing network 1909-14, 2. Helen Watts' activist network 1909-14**




**Edwards & Crossley 2009; Pajek, de Nooy et al. 2005**

The position of nodes on a sociogram can be manipulated to a degree for optimum layout, and thus the visualisations in themselves can be misleading as to structural properties. For example, the nodes at the centre of the diagram are not necessarily the most central in terms of their number of connections to others. A precise description of the network is achieved however by measuring various properties pertaining to network structure. Underpinned by graph theory, it is possible to measure properties like the overall network 'density', the 'centrality' of nodes within the network, 'brokerage' and 'closure' (see Burt 2005), the existence of 'cores' and 'cliques', and the extent of 'segregation'[4]. These kinds of structural measures provide indications, for example, of how ideas or resources may flow

[4] For definitions of network measures see Scott (2000) and Wasserman and Faust (1994).

through particular types of network (e.g. dense or sparse networks, centralised or de-centralised networks, open or closed networks). They also help in analysing the opportunities and constraints that actors experience as a result of their position within particular types of network (e.g. as 'isolates', 'brokers', or members of 'cliques'). Nodes in the sociogram can be sized according to properties like centrality, and given different colours and shapes in accordance with the attributes of actors (like gender, country, organisation etc).

The above describes the very basic procedures for beginning network analysis using computer software. It is possible to carry out advanced statistical analyses of a range of network properties using both UCINET, Pajek and other computer packages[5], without having to be a skilled mathematician, although some network analysts are. Blockmodelling techniques have also been developed to identify and analyse the different clusters of actors present within networks (White et al. 1976). Blockmodelling places actors in the same cluster or 'block' not on the basis of a tie between them, but if they share a similar profile of ties to other actors in the network, i.e. if they are in what is called a position of 'structural equivalence' (White et al. 1976). Recent developments in simulation, and computer packages like SIENA (Snijders 2001), can also explore network dynamics and processes over time by building upon statistical models.

It is not the purpose of this paper to delve any further into the quantitative techniques of SNA. These are well outlined in introductory and advanced fashion elsewhere (see Scott 2000; de Nooy et al. 2005; Wasserman and Faust 1994; Carrington et al. 2005). It is worth noting here however that quantitative approaches have made an indispensible contribution to the study of social networks. Using them it is possible to map (visualise) and measure (describe) social networks in a way that narrative accounts involving very large numbers of relationships could not easily do (a problem encountered by the early anthropologists who began to use matrices to record their data) (Mitchell 1969). Computer packages allow for data to be stored and mathematical procedures to be carried out quickly and easily. It has also been suggested that presenting data in matrices can aid the researcher in detecting patterns in the data that they would not have seen if the relations had existed only in words, and can thus lead to the formulation of new research questions (Hanneman and Riddle 2005). Furthermore, the structure of social relations can be analysed from the perspective of all actors in the network at the same time, and not just one individual perspective (Scott 2000, 13). Without

[5] Including amongst others: SIENA (Snijders 2001) which allows for investigation of longitudinal network data and Exponential Random Graph Modelling (P*); StOCNET (Huisman and Duijn 2003). See 'web resources' p.28.

these techniques the social network would remain a 'metaphor' in social research (Burt 1978; Scott 2000; Knox et al. 2006). It is nevertheless the case that these quantitative approaches have achieved a position of dominance in recent years, so much so that some researchers have been keen to express the value of qualitative approaches to SNA:

> 'Network analysis gains its purchase on social structure only at the considerable cost of losing its conceptual grasp upon culture, agency and process. It provides a useful set of tools for investigating the patterned relationship between historical actors. These tools, however, by themselves fail ultimately to make sense of the mechanisms through which these relationships are reproduced or reconfigured over time' (Emirbayer and Goodwin 1994, 1446-7).

> 'Network structure is not the whole story…and for that reason we need to supplement methods of formal network analysis with qualitative observations about what is "going on" within a network' (Crossley 2009a, 21).

Subsequently, some researchers have opted for a purely qualitative approach to SNA (Heath et al. 2009; Jack 2010), but in the main the response has been to try and find ways to mix both quantitative and qualitative approaches in network research (Mische 2003; Edwards and Crossley 2009; Crossley 2009a). The focus of the next section is not therefore upon replacing quantitative with qualitative methodologies, but upon the different ways in which the quantitative approaches can be combined with qualitative approaches to collecting and analysing relational data.

**Section Two: Combining Quantitative and Qualitative in Network Research**

Explicit calls for the revival of qualitative methods in network research are right to point to the current predominance of quantitative approaches in SNA. This is evident in the selection of data collection methods, for despite the roots of SNA in ethnography the key method of collecting relational data in network studies has been the 'name-generating' survey (Knox et al. 2006, 119). Those arguing for a revival of qualitative approaches are also right in pointing to the predominance of quantitative methods in the analysis of network data. Using the computer packages designed for SNA, there has been a concentration upon mapping and measuring network structure, as well as subjecting relational data to other statistical procedures (e.g. regression analysis, multi-level modelling, exponential random graph (P*) modelling, blockmodelling).

Whilst both of these arguments are valid ones, it would not however be accurate to say that there has been no attempt at combining quantitative and qualitative approaches in research on social networks in the last decade or so. On the contrary, alongside, and even before some of the explicit theoretically driven debates about mixing methods, there has been a body of SNA research which has combined quantitative techniques of SNA with qualitative methods. The ways in which researchers have done this has been very varied, as has the extent to which they posit broader arguments about the benefits of, or desirability of, mixed-method approaches. For example, one of the clearest ways in which quantitative SNA has been combined with qualitative approaches in the existing literature is by adopting qualitative methods for collecting relational data. In particular, ethnographic observations and semi-structured interviews have been used as 'name-generators' in a similar way to name-generating surveys. Observations and interviews can create a record of interactions between actors, or ask actors who they interact with, and these findings can then been transformed into the numerical data needed for matrices and statistical analysis. The extent to which the qualitative data generated by these studies is used in the *analysis* of social networks rather than just the construction of social networks is, however, variable.

In this section I discuss three main ways in which formal SNA has been combined with qualitative approaches by reviewing the existing (multi-disciplinary) research literature. I discuss some of these studies in detail, providing guidance on 'how to' mix methods in networks analysis on a practical level. I also consider the added-value that mixed-method approaches have brought to these various research projects.

### *1. Using qualitative approaches to inform the use of quantitative SNA and quantitative approaches to inform the use of qualitative SNA*

The first argument for combination that arises out of the existing literature is that quantitative SNA and qualitative methods can be mutually informative within the process of research itself. Various network research projects have adopted a multi-staged methodology in which qualitative research is a preliminary stage that informs quantitative SNA, or quantitative SNA is a preliminary stage that informs qualitative research. Studies have used ethnography for example in order to gain knowledge of the specific cultural context of the networks in question before designing name-generating survey questions. In their study of drug injectors' social networks in New York City, Neaigus et al. (1994) combined formal SNA with both ethnography and interviews. They used participant observation, in which they 'hung out' with drug injectors in the area over a period of time in order to better understand the nature and

meaning of drug injectors' networks. This ethnographic phase then informed the survey phase of network research, in which the drug injectors were asked to name the people with whom they had various kinds of contact. In a more recent study of adolescent friendship networks and peer influence on risk behaviour, Dolcini et al. (2005) also undertook a preliminary ethnography involving youth in the neighbourhood. Dolcini et al. suggested that this preliminary ethnographic stage was necessary in order to gain an awareness of the cultural context in which the network study was later conducted. It also enabled the researchers to design a network survey that was culturally and linguistically appropriate for young people in the area.

In other studies, qualitative and quantitative methods have mutually informed the research at more than one stage. In a panel study of the changing social networks of Argentinean migrants in Spain, Lubbers et al. (2009) used two stages of qualitative interviews two years apart. They collected quantitative network data within interviews via name-generating questions[6]. In order to do this in a systematic fashion, the interviews were assisted by a computer package called EgoNet, in which network data is input, and a visualisation of the network produced, within the interview itself (cf. participatory mapping). An in-depth interview then proceeded by asking the participant to talk further about the network map they had produced. Network maps were also generated and compared in the second interview where interviewees could use them as the basis of their narrative about how their personal ties had changed since the first interview. This method enabled the interviewee to comment on the network maps and point out any inaccurate, forgotten, or missing data. Thus the combination of interviews and formal SNA provided cross-referencing tools that could test the reliability of network maps and therefore help in estimating the amount of 'measurement error' involved in quantitative analysis (Lubbers et al. 2009). Both interview narratives about change, and quantitative analyses of the changes in network structure between the two time points, were then crucial for their analysis.

Whilst Neaigus et al. (1994) and Dolcini et al. (2005) used qualitative research as a start-point for quantitative SNA there has also been a recent trend towards using quantitative SNA as a start-point for qualitative research. In a study of classroom interactions and participatory learning methods, Martinez et al. (2003) adopted a mixed-method approach to SNA. They produced quantitative data on the structure of student interaction networks and

[6] Interviewees were asked to name 45 people they know, or knew by sight or by name, and with whom they had had some kind of contact in the past two years, either face-to-face, by phone, mail or email and whom they could still contact if they wanted to (Lubbers et al 2009, 4).

measured network density and the centrality of actors, but they also conducted classroom ethnographies to explore the students' perceptions of these structural patterns. Martinez et al. (2003, 366) argue that quantitative network analysis helped to highlight 'critical issues' to follow up in qualitative analysis, rather than analysing all of the qualitative data gathered.

Similarly, 'network ethnographies' of the internet have used formal SNA to inform their qualitative network research. Howard (2002), Biddix and Park (2008), Park and Kluver (2009), and Hepburn (2009) produce network maps as the first stage of research. Using the network maps and measures as a guide, they then select actors for further qualitative research (e.g. interviews) on the basis of their structural position in the network (see Howard 2002 for the origins of this technique). For example, Hepburn (2009) conducted a hyperlink analysis of websites in the campaign around the introduction of the congestion charge in Manchester, UK. The network maps of the hyperlinks between different sites, and the measures of the centrality of sites, were then used to target organisations for interview. Organisations were asked about their perceived position in the online network, and interestingly, Hepburn found that they were often unaware of their actual structural position, or the existence of the overall network of which they were a part. Park and Kluver (2009, 512) similarly followed up hyperlink analysis (in UCINET) of the blogs of Korea's National Assembly members with interviews involving the authors of the blogs in order to aid their analysis of the changes in online network behaviour over time.

It is clear from these studies that mixing-methods in network analysis can have beneficial results for the process of research itself, and that quantitative methods and qualitative methods can be mutually informative in multiple stages of research.

### *2. Mixing quantitative and qualitative methods of data collection and analysis*

The second argument for combining quantitative SNA and qualitative research arises out of studies which have mixed quantitative and qualitative methods at both the level of data collection *and* analysis. In this respect, network researchers have opted for some form of 'triangulation', i.e. using different forms of data to explore the same phenomenon. As early as 1987, Lievrouw et al. (1987), explicitly employed 'triangulation' as a research strategy for network analysis in a study of the network of intellectual connections between biomedical scientists. They produced 'co-citation networks' in order to explore intellectual links and created network maps. They also interviewed the scientists involved about their intellectual relationships. They argued that the interviews provided analysis with a historical perspective on ties and contextual information about the network. They suggest that whilst triangulation

may be more labourious and produce ‘messy results’ for network analysts compared to statistical models alone, mixing methods nevertheless gives a better understanding of the social network and the results ‘probably reflect the actual “messiness” that is typical of most social networks’ (Lievrouw et al. 1987, 245).

The strategy of using qualitative interviews to aid the analysis and understanding of network maps and measures has also been employed in much more recent research by Bidart and Lavenu (2005), Chiu and West (2007) and Bellotti (2008). In their panel study of the personal networks of young people in Normandy, Bidart and Lavenu (2005) used name-generating surveys with young people which were conducted every three years to produce longitudinal network data. The survey was then followed up by qualitative interviews which probed changes in personal relations in depth and detail. Bidart and Lavenu (2005, 373) argue that qualitative and quantitative SNA are complimentary because the number of ties alone cannot contribute to an understanding of the ‘quality’ of ties, or the exact ways in which ties provided ‘access to resources’. In Chiu and West’s (2007) study of the social networks of Community Health Educators (CHEs) in local neighbourhoods, they argued that it was a necessity to both map the personal networks of CHEs and to use focus group interviews to look at the perception that CHEs had of their networks. In a similar way to Lubbers et al. (2009), both the mapping of networks and the focus group discussions both took place within the interview context. Chiu and West wanted to know whether the CHEs were aware of their networks within the neighbourhood and how they utilised their networks as part of their job. It was therefore necessary to gain both an ‘outsider’ view on the network structure and an ‘insider’s’ perception of the network, and these dual aims were responsible for producing a ‘mixed method design’ (Chiu and West 2007, 1918). A similar rationale for mixing methods was adopted by Bellotti (2008) in her study of the friendship networks of young single people in Milan, Italy. Bellotti used a name-generator technique to map the friendship networks of egos in UCINET, and then conducted biographical interviews to explore how friendship is variously defined and how the meaning and significance of friendship ties changes over time. By mixing methods, Bellotti (2008) is able to both compare the structure of different friendship networks and develop typologies, as well as comment upon the meaning of friendship in the lives of young singletons.

Conti and Doreian (2009) also integrate quantitative and qualitative methods and analysis in their research design, but qualitative data is generated by ethnography rather than interviews. Their research focuses upon the social networks between new recruits in a police training academy, and looks at whether the efforts to foster friendship ties between recruits of

different races using ethnically diverse 'squads' and set seating plans were successful. Network data were collected via survey questionnaires which were distributed at three time points throughout the training, asking recruits who they knew and who they had become friends with. This data was used for statistical analysis. The ethnography on the other hand, was conducted by overt participant observation in the training sessions and this produced 'contextual' data that was outside the remit of the quantitative methods (Conti and Doreian 2009, 12). What is interesting is that Conti and Doreian found that the ethnographic material told a very different story from the quantitative analysis as regards to racial solidarity. Quantitative analysis of the network data showed for example that the use of racially diverse squads in police training did lead to higher levels of friendship between recruits of different races. Adversely, however, the ethnographic research uncovered a much higher level of racial tension within the group, as well as racist attitudes and language (Conti and Doreian 2009, 15). The quantitative analysis of network data was therefore inappropriate for accessing certain kinds of group dynamics that may have gone on to affect the formation of social networks when recruits left the academy and became police officers. At best, the quantitative analysis was only one part of the story, and could not be accurately interpreted without the contextual information provided by the ethnography.

Combining quantitative and qualitative methods of data collection and analysis in these projects added value to the research in three main ways: 1. mixing methods contributed to an awareness of *context* and an ability to take account of this context when interpreting the quantitative network data; 2. mixing methods enabled researchers to gain an *'outsider'* view of the network in terms of the structure of the network (which could not be seen by any one individual actor), but also to gain data on the perception of the network from an *'insider's'* view, including the content, quality and meaning of ties for those involved; and, 3. it is no coincidence that many of the studies using mixed-methods of data collection and analysis have a focus upon *change* over time in their research questions. By combining methods they are able to map the evolution of the structure of networks over time, by, for example, panel surveys, but also to explore in depth the reasons for change using qualitative methods.

### *3. Mixing qualitative methods of data collection with mixed-method data analysis*

What is notable about the studies discussed above is that by and large they still employ survey methods for collecting network data and then mix this method with other qualitative forms of data collection and analysis like interviews and ethnography. In the existing literature there are, however, some studies which suggest that mixing methods in network

research should only happen at the level of *data analysis.* This is not because they preserve a prime place for the name-generating survey questionnaire. On the contrary, it is because they argue that *qualitative* methods of data collection are superior for collecting relational data. The analysis of this data does however benefit from a mixed-method approach using quantitative SNA and qualitative methods like content and discourse analysis.

This argument has been made by Coviello (2005) in the business literature which explicitly addresses the question of integrating methods in SNA. Coviello seeks this integration solely at the level of analysis rather than data collection. Coviello argues that relational data are best collected using qualitative methods *rather than* quantitative methods, or even a mix of methods. This is because whilst quantitative data is 'uni-dimensional', qualitative data can be analysed both quantitatively and qualitatively (Coviello 2005, 43). Importantly, qualitative data on networks can not only be transformed into numerical data for statistical analysis, but it can also be subject to content analysis to explore meanings, perceptions and dynamic processes, whilst simultaneously providing crucial contextual details that aid in the interpretation of structural measures. The combination of quantitative and qualitative is then achieved at the level of analysis, employing what Coviello (2005) calls a 'bifocal' approach to network analysis. Network maps are still produced and structural properties of the network measured using UCINET (and these maps are even shown to interviewees in later stages of interviews), but the interview narratives are also analysed to unpack the 'life-story' of, in Coviello's case, the firm (2005, 43). Crucially, the qualitative interview data is also used to enable the researcher to understand what the network maps and measures actually mean. This integrated approach is seen as more adept at analysing network dynamics and change over time in the context of an entrepreneurial firm.

A very similar approach has recently been adopted in sociological research on networks, which uses qualitative methods like ethnography and historical archival research to generate relational data that can then be analysed both quantitatively and qualitatively. Crossley's (2008a) study of group dynamics in a private health club used ethnography as its primary method of data collection. Participant observation of the interactions between members of a fitness class led to the construction of matrices and sociograms. Using network measures, Crossley was able to pinpoint the position of key actors who were 'brokers' between two cliques within the class. The ethnographic material was essential however to the way in which Crossley was able to interpret this brokerage role, which was less a position of advantage (Burt 2005) than of conflict and tension. This led Crossley to conclude that structural properties of networks are mediated by the content and meaning of ties to the

extent that qualitative methods become a necessary part of data analysis as well as useful tools for data collection. Crossley maintains that we simply cannot interpret what the networks measures mean without qualitative research. In an explicit discussion of mixing methods in SNA, Crossley (2009a) suggests that SNA and qualitative research are mutually informative, and his use of SNA comes 'sandwiched between two slices of more conventional, interactionist-type observation and analysis' (Crossley 2009a, 17).

The strengths of a mixed-method approach were reinforced in Crossley's (2008b; 2009) other work on the networks of the early Punk scene in Manchester and London, and in Edwards and Crossley's (2009) examination of the personal network of a militant suffragette. In both these studies, relational data were constructed from historical archives, including suffragette letters and speeches, and secondary sources like published auto-biographies and newspaper accounts. This historical material provided not only relational data for quantitative network analysis about the structure of these networks, but rich, narrative accounts about the meaning of ties over time and the perception of the network from those within it. Using historical letters as a source of data on suffragette networks was seen as particularly useful for example, as letters contained relational data in terms of 'who was writing to whom', and writers would further 'talk their ties' within the course of letter writing. Also, letters tend to be dated, allowing for an analysis of the evolution of ties over time (Edwards and Crossley 2009).

Constructing relational data from historical sources is not an unproblematic exercise, however. In particular, consistent criteria of judgment need to be applied in terms of what 'counts' as a tie (e.g. any contact? Proven friendship?), but this can be difficult to sustain across different historical sources which contain varying amounts of information on the quality and content of ties. For example, there are big variations in how social relationships are written about in newspapers, compared with letters, or autobiographies or diaries. The advantage of using historical and archival sources however is that they can be referred back to when considering just what the ties presented in a sociogram mean to various actors involved, even if there are inevitable gaps. The sociograms in this research therefore never 'stand alone', but are in constant dialogue with the qualitative sources from which they were constructed in the first place. It is also important to acknowledge that sociograms are representations of the relational data specific to certain types of interactions (in Edwards and Crossley's case, political activism) and as contained within these surviving sources. They are 'abstractions' and models rather than the actual network of interaction (Peay 1980).

In Coviello (2005), Crossley (2008a; 2008b; 2009; 2009a), and Edwards and Crossley (2009), what we find therefore is that quantitative and qualitative network analysis both draw upon *the same (qualitative) sources of data,* and are able to analyse and represent this data in very different, but nevertheless complimentary, ways.

**Section Three: Theoretical Debates about Mixing Quantitative and Qualitative in SNA**

There are both practical and theoretical arguments for combining quantitative and qualitative approaches to network research which arise out of the review in section two. The practical strand of the argument seems to suggest that *different research questions require different methods*. In particular, research questions about the structure of social relations require quantitative (sociometric) methods, whereas research questions about the processes that produce networks, the perception and meaning of networks, or change over time, require qualitative methods.

In the business literature, Monsted (1995) for example, argues that quantitative methods can enable research of stable, well established network structures, but are not appropriate for looking at the processes by which new network structures emerge (in Monsted's case this is the process of networking involved in establishing a new business). Monsted suggests therefore that 'certain methodologies limit the concept *[of network]* and change its contents to more structural and static characteristics' (Monsted 1995, 194, my italics). He suggests further that some types of ties, in particular latent, very weak, or emerging ties, are not readily recorded in data matrices but are sometimes the most important ties for bringing about change[7]. Monsted argues that quantitative SNA 'blinds us' to the more fluid aspects of networks and their potential for transformation (1995, 201).

Jack (2005) makes a similar point in the business context, suggesting that some aspects of networks are not readily accessible through the quantitative approaches that dominate the field and opts for a wholly qualitative approach to looking in-depth at networking activities in the context of entrepreneurship. In an explicit discussion about mixing methods in SNA, Jack (2010) argues for a combination of quantitative and qualitative methodologies as the ideal strategy for network research. The reason she presents for this is because a combination of methods can deal with *different* features of networks; either 'structure' (quantitative methods) or 'process' (qualitative methods). Added together, these two approaches provide a more 'complete understanding of networks' (Jack 2010, 121). They

[7] See Granovetter (1973) for a discussion of tie strength and the concept of 'weak ties'.

enable an appreciation of the network from both an 'outsider' perspective (what Jack calls the 'copernican' viewpoint), and an 'insider' perspective (what Jack calls the 'ptolemaic' viewpoint).

These sorts of practical concerns about certain methodologies being more or less appropriate for pursuing different types of research questions quickly become attached to more theoretical issues. In the most recent sociological literature on combining methods in network analysis, Crossley (2009a) discusses a version of the 'division of labour' approach to network methodologies, but argues that answering sociological research questions will more often that not require both quantitative and qualitative methods for theoretical reasons. Quantitative methods enable researchers to 'spot structures' (Crossley 2009a, 6) which cannot be done using qualitative approaches alone. He argues that whilst quantitative methods can explore 'relational form' however, qualitative methods are necessary for exploring 'relational content', or what he calls the 'social world of the network' (Crossley 2009a, 6). We need both of these in social network research because qualitative approaches lack a systematic way to record and present data and to unpack social structure, whilst the quantitative approach to networks 'over-abstracts' and 'over-simplifies' the social world of the network and produces measures that cannot be adequately interpreted when divorced from the social context (Crossley 2009a, 8). For Crossley, the important caveat is that:

> 'Relationships are not things that are either absent or present. Nor are they uniform. They are lived histories of iterated interaction which constantly evolve' (Crossley 2009a, 8).

Sociologists are interested in networks in the context of 'social worlds' and therefore both quantitative and qualitative approaches are necessary because form and content always 'mediate' one-another (Crossley 2009a, 11).

White (1992), Mische and White (1998), Riles (2001), Mische (2003) and Knox et al. (2006) have also provided more theoretically driven arguments which support the integration of quantitative and qualitative methods in network research. White (1992) argues that networks are embedded in what he calls 'domains' (e.g. the family domain, the friendship domain, the work domain). These domains are characterised by a different set of narratives or 'stories' to which networks orientate and which actors constantly 'switch' between (Mische and White 1998). Actors are always embedded in multiple network domains ('netdoms'), and as such orientate to multiple stories, have multiple identities, and multiple types of interactions. This focus on what we might call 'multiplexity' in networks (the idea that ties

are of different types, e.g. friendship, work etc, and sometimes combined, e.g. a friend who is also a colleague) and the way in which these 'netdoms' are structured around stories (White 1992), emphasises the complex, interactional, and discursive nature of social networks. This point is taken up by Mische (2003, 258) who argues that researchers should stop seeing networks as 'conduits' or 'locations' for cultural formations such as identities and narratives, and start seeing networks as culturally constituted by these in the first place. Actors have to constantly negotiate their multiple network ties through communicative interaction (Mische 2003). Mische (2003, 258) usefully reminds researchers therefore that 'relations in networks are about what people do in interaction'.Whilst pointing to the tension between formal SNA and ethnography (which exists because 'each involves the necessary reduction of the other', Mische 2003, 265), she nevertheless calls for quantitative SNA to be combined with qualitative approaches. Network maps can aid an understanding of the overall structure of a network, whilst ethnography and methods like conversation analysis can explore the cultural and communicative processes that produce and reproduce networks. The inability of formal SNA to handle questions of culture and interactional processes is therefore a key theoretical argument for developing and combining methodologies (see Emirbayer and Goodwin 1994).

Significantly however, the idea that networks are rooted in stories means that networks are also cultural formations in themselves, and can be studied as such by looking at the kinds of narratives that actors within the network use to describe it (Riles 2001). Talking about this 'cultural turn' in network research in sociology and anthropology, Knox et al. (2006) argue that this kind of approach means that descriptions of the network become part of the analysis of the network (because networks, as above, are to be defined by sets of stories). Knox et al. (2006) discuss Riles (2001) treatment of the network as a cultural form to illustrate this point: Riles argues that 'the network' (e.g. as mapped) and 'personal relations' (e.g. as described) are versions of one-another 'seen twice'. The narrative descriptions of relations are the 'inside' of the network, and the model that visualises or represents these relations is the 'outside' of the network. The interesting point is that the network is both of these things, just seen in a different way. This brings us back to the point made earlier, that SNA offers a specific opportunity for combining methods because network researchers can ask questions from 'outside' or 'inside' the network. Riles (2001) maintains further that it is possible not only to look at the network from the 'outside' or the 'inside', but also, in her terms, to 'turn the network inside out'. The specific opportunity that SNA provides for combining quantitative and qualitative approaches does not therefore come from the fact that networks have different features – the structure (outside) and process (inside) – and that for

practical reasons we require different research methods to study these, but because the outside and the inside are essentially versions of the same thing. Knox et al (2006) state:

> 'Unlike other objects that find themselves more clearly demarcated as either qualitative or quantitative categories, the network produces a discursive gap…the network holds the potential to be simultaneously referent and representation in a way that is both dangerous and productive' (Knox et al. 2006, 135).

**Conclusion**

There may not be a vast amount of explicit debate about integrating quantitative and qualitative approaches in research on social networks. What there is exists most clearly within the business literature where quantitative SNA has most clearly dominated (Monsted 1995; Coviello 2005; Jack 2005, 2010). Calls have also been steadily emerging within theoretical debates in sociology and anthropology (Emirbayer and Goodwin 1994; Mische and White 1998; Mische 2003; Riles 2001; Knox et al. 2006; McLean 2007) as well as very recent sociological network research (Crossley 2008a, 2008b, 2009, 2009a; Edwards and Crossley 2009). It is also clear however from a review of existing research literature across a variety of disciplinary fields that attempts at combining quantitative and qualitative approaches in individual projects has been present in at least the last decade or so. By looking at how researchers have used mixed-methods in their projects it is possible to see the ways in which quantitative and qualitative data and analysis can be mutually informative. A mixed-method approach can add value in several areas. Qualitative approaches add an awareness of *context* which aids the interpretation of network maps and measures; they add an appreciation of the perception of the *network from the inside*; and an appreciation of the *content of ties* in terms of quality, meaning, and *changes over time*. What is also clear however from the variety of ways in which methods have been mixed, is that there is no 'one best way' of integrating quantitative and qualitative methods in SNA. As such, there is both a great deal of innovation in existing research designs, and a lot more room for methodological development in the future.

The theoretical arguments for mixing methods re-focus attention upon the lived realities of social relations; the ways in which networks are culturally constituted processes of communicative interaction (Mische 2003), embedded in overlapping identities and narratives (White 1992) that characterise 'social worlds' (Crossley 2009a). Essentially the theoretical point surrounds that inevitable interplay between 'form' and 'content' which is ever present

in scenarios of human interaction. But maps and measures of the 'form' of relations, and narratives about the 'content' of relations are not so easily divided between different research questions in the way that the 'inside'/'outside' argument for combination suggests (Jack 2010). Instead, an understanding of either requires the other; like the 'two sides of the same coin' argument so often raised in sociological debates about the interplay between structure and agency (Giddens 1986). Whilst we may divorce form from content, or structure from agency for analytic purposes, it is in that 'messiness' of actual social networks that Lievrouw et al. (1987) talked about that they are always combined, and therefore, perhaps, so should the methods which we use to study them.

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**Web Resources**

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Pajek (de Nooy, Mrvar and Batagelj 2005) can be downloaded for free from the internet: http://vlado.fmf.uni-lj.si/pub/networks/pajek/

SIENA (Snijders 2001) webpage: http://stat.gamma.rug.nl/siena.html

StOCNET (Boer et al.) webpage: http://stat.gamma.rug.nl/stocnet/

UCINET (Borgatti, Everett and Freeman 2002) can be downloaded from the internet for a free 60 day trial: http://www.analytictech.com/downloaduc6.htm
UCINET software contains NetDraw (Borgatti 2002)

International Network for Social Network Analysis (INSNA) webpage: http://www.insna.org/