Editorial: Applied and methodological issues in the analysis of network data

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The Social network perspective has grown in popularity because it enables a very natural approach to model relationships among interacting units. The relationships linking units may be of many sorts: economic, political, interactional or affective to name just a few. Social network analysis encompasses theories, methods and applications that are expressed in terms of relational concepts or processes (Wasserman and Faust 1994; Scott 2000).

The large interest in social networks stems from the theoretical research questions and the challenging methodological problems associated with the collection and analysis of social network data. Conventional data focuses on units or *actors and their attributes*, network data focus on *actors and relations*. This difference in emphasis motivates the choices that a researcher has to make about research design, sampling strategies, measurement, and analysis of resulting data. Progress in the statistical analysis of social networks has been impressive in the last two decades, with increasing attention devoted to network modelling and to longitudinal network dynamics (Snijders et al. 2006; Kolaczyk 2009; Krivitsky et al. 2009; Handcock and Gile 2010; Snijders and Doreian 2010).

This special issue of Quality and Quantity comprises six papers, written by renowned experts in the field from a number of countries. In each work, methodological and specific application issues that may be involved in network analysis are discussed.

Three papers have been chosen from the ones presented at the international workshop *Social Network Analysis: Models and Methods for relational data* (ARS09), held at the University of Salerno, Italy on 13–14 July 2009. The focus of ARS 09 was on recent developments in the area of network analysis (networks visualization, dynamic networks, large networks, blockmodeling and statistical issues in modelling network data) and on applications in

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different fields (collaboration networks, networks in politics and organization networks in business and economics).

Two invited papers open this special issue. The first one is written by Kronegger et al. (2011). The authors address the issue of time evolution in co-authorship structures exploring complete longitudinal co-authorship links at the micro-level of scientists for 1986–2005 in Slovenia. The co-authorship networks for four research disciplines (biotechnology, mathematics, physics and sociology) are compared to verify known hypotheses and new ones on co-authorship patterns. Using blockmodeling techniques, the authors show how co-authorship structures change in all disciplines along time. The most frequent form is a core-periphery structure with multiple simple cores, a periphery and a semi-periphery. The next most frequent form has this structure but with bridging cores that consolidate the center of a discipline by giving it greater coherence. These consolidated structures appeared at different times in different disciplines, appearing earliest in physics and latest in biotechnology. Two comments, one by Light and Moody (2011) and one by Everett (2011), highlight the discussion on the understanding of the dynamics of scientific collaboration. A rejoinder by the authors (Doreian et al. 2011) follows.

The second invited paper by Maggioni and Uberti (2011a) provides a wide-ranging review of the most relevant problems and open questions that arise in the economic geography of knowledge flows. The reader is offered a thorough illustration of the interaction between "networks" and "geography" elements within a theoretical, methodological and empirical perspective to demonstrate that "networks" and "geography" are the necessary ingredients for every study of the innovative process at any level of analysis: from individual agent, to institution/organization, from the regional to the national and international level. The discussion is enriched by two comments contributed by Massard (2011), and by Ter Wal (2011). A rejoinder by the authors (Maggioni and Uberti 2011b) follows.

Four papers follow: the first two deal with theoretical topics often at issue in Social Network Analysis, and the last two present interesting applications of Social Network methods in relevant scientific fields.

The paper by Fuhse and Mützel (2011) provides a contribution to the ongoing discussions on a mixed methods approach in network research. Starting from a historical overview of several strands of network research, the authors aim is to systematize the role of qualitative methods, statistical analyses, and formal network analysis in sociological network research, arguing for their systematic combination.

The paper by De Stefano et al. (2011) is on the stream of research on co-authorship networks. It deals with the methodological issues that arise in the different phases of the analysis of scientific collaboration. The paper focuses on data collection, network boundary setting, relational data matrix definition, data analysis and interpretation of results, providing a discussion of the different choices that can be made in these phases. By means of an illustrative example on real data which refer to scientific collaboration among researchers affiliated to an academic institution, the authors compare global and actor-level network measures computed from binary and weighted co-authorship networks in different disciplines.

In the paper by Zappa (2011), social network analysis is applied to model knowledge sharing in prescribing a new drug among hospital physicians. Drawing on the literature on the diffusion of innovation and cooperation in clinical settings, knowledge sharing about the innovation is represented in the paper as a network. Several Exponential Random Graphs (ERG) or p* models for network data from a sample of about 800 Italian hospital physicians are specified in order to reconstruct the network structure of knowledge sharing and to test the effect of exogenous factors on the tendency to take action in the network. The results are interesting and show that knowledge informally flows, exploiting mutual advice-seeking

relationships of small clustered groups consisting of similar peers that work in the same organization.

The paper by Brancaccio (2011), which deals with the relational networks of councillors at district level, closes the issue. District councils are the result of the administrative decentralization of the major Italian municipalities. They are the smallest administrative divisions within the Italian political system and represent the nearest institutional-elective level to the voters. In order to increase the understanding of the political networks, the analysis combines qualitative and quantitative data on councillors meetings and activities collected during 2003–2004 in the city of Naples.

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References

Brancaccio, L.: Among leaders and territories: the political networks of the district councillors in Naples. Qual. Quant. (2011). doi:10.1007/s11135-011-9495-0

De Stefano, D., Giordano, G., Vitale, M.P.: Issues in the analysis of co-authorship networks. Qual. Quant. (2011). doi:10.1007/s11135-011-9493-2

Doreian, P., Ferligoj, A., Kronegger, L.: On the dynamics of national scientific systems: a reply. Qual. Quant. (2011). doi:10.1007/s11135-011-9487-0

Everett, M.: Comment on Kronegger, Ferligoj and Doreian. On the dynamics of national scientific systems. Qual. Quant. (2011). doi:10.1007/s11135-011-9486-1

Fuhse, J., Mutzel, S.: Tackling connections, structure, and meaning in networks: quantitative and qualitative methods in sociological network research. Qual. Quant. (2011). doi:10.1007/s11135-011-9492-3

Handcock, M.S., Gile, K.: Modeling social networks from sampled data. Ann. Appl. Stat. **4**, 5–25 (2010)

Kolaczyk, E.D.: Statistical Analysis of Network Data: Methods and Models. Springer Verlag, Heidelberg (2009)

Krivitsky, P.N., Handcock, M.S., Raftery, A.E., Hoff, P.D.: Representing degree distributions, clustering, and homophily in social networks with latent cluster random effects models. Soc. Netw. **31**, 204–213 (2009)

Kronegger, L., Ferligoj, A., Doreian, P.: On the dynamics of national scientific systems. Qual. Quant. (2011). doi:10.1007/s11135-011-9484-3

Light, R., Moody, J.: Dynamic building blocks for science: Comment on Kronegger, Ferligoj, and Doreian. On the dynamics of national scientific systems. Qual. Quant. (2011). doi:10.1007/s11135-011-9485-2

Maggioni, M.A., Uberti, T.E.: Networks and geography in the economics of knowledge flows. Qual. Quant. (2011a). doi:10.1007/s11135-011-9488-z

Maggioni, M.A., Uberti, T.E.: Networks and geography in the economics of knowledge flows: a rejoinder. Qual. Quant. (2011b). doi:10.1007/s11135-011-9491-4

Massard, N.: Discussion on Maggioni M.A., Uberti T.E. Networks and geography in the economics of knowledge flows. A comment. Qual. Quant. (2011). doi:10.1007/s11135-011-9489-y

Scott, J.: Social network analysis: a handbook. 2nd edn. Sage publications, London (2000)

Snijders, T.A.B., Doreian, P.: Introduction to the special issue on network dynamics. Soc. Netw. **32**, 1–3 (2010)

Snijders, T.A.B., Pattison, P.E., Robins, G.L., Handcock, M.S.: New specifications for exponential random graph models. Sociol. Methodol. **36**, 99–153 (2006)

Ter Wal, A.L.J.: Discussion on Maggioni M.A., Uberti T.E. Networks and geography in the economics of knowledge flows: a commentary. Qual. Quant. (2011). doi:10.1007/s11135-011-9490-5

Wasserman, S., Faust, K.: Social network analysis: methods and applications. Cambridge University Press, Cambridge (1994)

Zappa, P.: The network structure of knowledge sharing among physicians. Qual. Quant. (2011). doi:10.1007/s11135-011-9494-1