Chapter 16
Social Network Analysis: A Brief Introduction to the Theory

Şefika Şule Erçetin and Nilay Başar Neyişci

Abstract Social networks are self-organizing, emergent, and complex, such that a pattern appears from the interaction of the elements that make up the system (Newman M, Barabási AL, Watts DJ. The structure and dynamics of networks. Princeton studies in complexity. Princeton University Press, Oxford, 2006). These patterns become more apparent as network size increases. Social network analysis is a collection of concepts, measures, and techniques for relational analysis. It is an approach that is specifically designed to grasp the most important features of social structures and it is unrivalled in this task. It can be used to explore social relations themselves and also the cultural structures of norms and ideas that help to organize those relations in conjunction with material circumstances. The study discusses the ways in which relational and cultural structures can be investigated with a few simple network concepts. Theories of social structure inform and sustain the methods of social network analysis.

16.1 Introduction

Social network analysis is an applicable method for investigating relations and interactions. Social network analysis (SNA) is an approach rooted in anthropology, sociology and social psychology for assessing social structures [3, 16]. The social network perspective illustrates social systems as networks of various relationships [2, 12]. SNA centers upon the structure and design of relationships and explores to describe both their causes and consequences [3, 7, 17].

Ş.Ş. Erçetin (✉)
International Science Association (ISCASS), Ankara, Turkey

Faculty of Education, Hacettepe University, Ankara, Turkey
e-mail: sefikasule@gmail.com

N.B. Neyişci
Department of Educational Management, Planning, Supervision and Economics, Faculty of Education, Hacettepe University, Ankara, Turkey
e-mail: nilbasar@hacettepe.edu.tr

Ş.Ş. Erçetin (ed.), *Chaos, Complexity and Leadership 2014*,
Springer Proceedings in Complexity, DOI 10.1007/978-3-319-18693-1_16

It is over than 50 years that theory of social networks and the assumptions of sociometry and sociograms were developed. Barnes [1] is credited with the invention of the social network idea, in the early 1950s about a Norwegian island parish.

Organizations are considered to be social entities where a position can be measured by social-psychological and demographic data. Location and connection to others provides information about members and group identification. A person's perceived position is essential in determining his or her beliefs, interests and motivation for action [6, 7, 13]. Additionally, people with close ties tend to maintain similar interpretations of the organizational environment [5] and tend to act similarly. This result flows of social information and the tendency for people to seek out similar others.

Social network theory examines how the social structure of relationships encompassing people, group, or organization influences beliefs or behaviors. SNA addresses a set of methods for distinguishing and determining the patterns. The proposition of network approach is about the conception of reality that fundamentally perceived and investigated from the aspect of the attributes of relations between and within components instead of the attributes of these components themselves. In this relational approach, these components are social components: individuals, organizations and societies.

16.2 Outlook

SNA predominantly concentrates on the relationships between people, instead of on typical features of people. Analysis of relationships will support to discover the informal communication diagrams in an organization, which may then be declared to the formal communication structures. These diagrams can be used to define certain organizational experiences. The relationship diagrams contribute to actors with some analogies of the attitudes and behaviors of other organizational members; SNA may explain why members develop certain attitudes toward organization.

16.3 Utilization

SNA techniques spotlight the communication structure of an organization. The use of network analysis techniques distinguishes structural features such as the (formal and informal) communication patterns and the description of groups within an organization like cliques or functional groups. Also information flow between members can be determined. By using SNA techniques, further characteristics could be investigated which are the communication task perceived by employees, the communication styles and the effectiveness of the information flows. Social networks are examined at the extent to the theoretical question of researcher. Even

though levels of analysis are not necessarily reciprocally restricted, there are three network levels: micro-level, meso-level, and macro-level.

16.4 Micro Level

At the micro-level, social network research usually founded with an individual, escalating with social relationships, or beginning with a small group of individuals in a particular social context.

Dyadic level: Dyad means a set social relationship between two individuals. Social network investigation about dyads focuses on framework of the relationship (e.g. complexity, effectiveness), social equality, and trends toward reciprocity/mutuality.

Triadic level: "Add one individual to a dyad, and you have a triad". In this level, SNA may consider closely on factors such as balance and transitiveness, along with social equality and tendencies toward reciprocity/mutuality [11].

Actor level: In a SNA the fundamental unit is an individual in his/her social environment, like "actor" or a "ego". Ego-network analysis concentrates on network features such as intensity, connection strength, density, centrality, status, connections, and ties [10]. This level of analysis is generally used in psychology or social psychology, ethnographic kinship analysis or genetic studies of ties.

Subset level: In this level, issues may start at the micro-level of analysis, however may traverse into the meso-level. It brings out on distance and attainability, cliques, united subgroups, or other group actions [9].

16.5 Meso Level

Essentially, theories in this level may interest in demography between the micro- and macro-levels. Nonetheless, it refers to analyses that are particularly constructed to acknowledge connections between micro- and macro-levels. With its low density feature Meso-level networks may demonstrate causative processes differing from interpersonal micro-level networks.

Organizations: Formal organizations are social groups that arrange tasks for a collective goal [14]. Organizational SNA may concentrate both on intra-organizational and inter-organizational connections as regards formal or informal ties. Networks inside an organization generally comprehend multiple levels of analysis, notably with multiple or semi-autonomous divisions. In such organizations, SNA is managed at a division and organization level, focusing on the interaction between the two networks [14].

Randomly distributed networks: In the 1980s, exponential random graph models of networks emerged as brand new methods of SNA. This structure represents social-structural consequence witnessed mainly in many human social networks,

besides the general degree-based structural consequences in any social networks including reciprocity and transformation, and at the node level and attribute-based activity and popularity effects, because of borrowed from explicit theories about reliance among network ties. Parameters are disposed with respect to the predominance of small sections of graph composition in the network. Description of these parameters may be as expressing the consolidations of social processes, which bring about emerging a network. These probability network models for a set of actors allow regulation beyond the definitive dyadic self-reliance acquisition of micro-networks, allowing designs to be raised from theoretical structural organizations of social behavior [8].

Scale-free networks: Their degree distribution at least asymptotically accompanies a power law. In SNA theory, these networks have the degree distribution that extricates social groups' size distribution [8]. The distinguishing aspects of scale-free networks diverge alongside the theories and analytical mechanisms accustomed to construct them. Nonetheless scale-free networks in general have some collective characteristics. The relative commonness of vertices with a degree that greatly overtake the average is one of their outstanding characteristics. The highest-degree nodes, often called "hubs", may give definite functions in their networks, even if depending mainly on the social context. The clustering coefficient distribution, which declines as the node degree inclines, is a further characteristic of scale-free networks. This distribution again accompanies a power law [4].

16.6 Macro Level

Macro-level SNA; commonly detect the reactions of communications such as economic or other resource transfer interactions over a huge population, instead of detecting interpersonal communications. "Macro-level" network is primarily used similar as large-scale network in social and behavioral sciences, in economics. The term was applied initially extensively in the computer sciences.

Macro-level social networks exhibit specialties of social complexity, including important significant characteristics of network topology, alongside patterns of complex connections between complex elements (chaos theory, dynamical system and complexity science). These characteristics involve a heavy tail in the degree distribution, a high clustering coefficient, hierarchical structure, and community structure, assortativity or disassortativity among vertices. These characteristics further involve reciprocity, triad significance profile in the matter of agency-directed networks. On the contrary, several mathematical networks models as lattices and random graphs, do not demonstrate such characteristics [15].

SNA is concentrated on revealing the design of interaction between people. It is based on this design, which is an important feature of individuals. Choices of individual depend noticeably on how s/he is connected with the larger network. Social network approach is regulated by formal theory organized in mathematical terms, and grounded in the systematic analysis of empirical data. It has found

important applications in organizational behavior, inter-organizational relations, and the spread of contagious diseases, mental health, social support, the diffusion of information and animal social organization.

References

1. Barnes J (1954) Class and committees in a Norwegian Island Parish. Hum Relat 7:39–58
2. Brass DJ (1992) Power in organizations: a social network perspective. Res Polit Soc 4:295–323
3. Borgatti SP, Foster PC (2003) The network paradigm in organizational research: a review and typology. J Manag 29:991–1013
4. Barabási A-L (2003) Linked: how everything is connected to everything else and what it means for business, science, and everyday life. Plum, New York
5. Burt RS (1976) Positions in networks. Soc Forces 55:93–122
6. Burt RS (1982) Toward a structural theory of action. Academic, New York
7. Burt RS (1992) Structural holes: the social structure of competition. Harvard University Press, Cambridge
8. Cranmer SJ, Desmarais BA (2011) Inferential network analysis with exponential random graph models. Polit Anal 19(1):66–86
9. de Nooy W (2012) Graph theoretical approaches to social network analysis. In: Meyers RA (ed) Computational complexity: theory, techniques, and applications. Springer, New York, pp 2864–2877. doi:10.1007/978-1-4614-1800 9_176. ISBN 978-1-4614-1800-9
10. Jones C, Volpe EH (2011) Organizational identification: extending our understanding of social identities through social networks. J Organ Behav 32:413–434
11. Kadushin C (2012) Understanding social networks: theories, concepts, and findings. Oxford University Press, Oxford
12. Lincoln JR. (1982) Intra (and inter-) organizational networks. In: Bacharach SB (eds) Research in the sociology of organizations, vol 1. JAI Press, Greenwich, CT
13. Reis HT, Collins WA (2004) Relationships, human behavior and psychological science. Curr Dir Psychol Sci 13:233
14. Riketta M, Nienber S (2007) Multiple identities and work motivation: the role of perceived compatibility between nested organizational units. Br J Manag 18:61–77
15. Strogatz SH (2001) Exploring complex networks. Nature 410:268–276. doi:10.1038/35065725
16. Tichy N, Fombrun C (1979) Network analysis in organizational settings. Hum Relat 32:923–956
17. Tichy NM, Tushman ML, Fombrun C (1979) Social network analysis for organizations. Acad Manage Rev 4:507–519