Lecture Notes in Social Networks

Song Yang *Editor*

Social Network Analysis in Action

Basic Methods and Applications

Springer

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About the Editor

Song Yang is professor of Sociology at the Department of Sociology and Criminology, University of Arkansas. His research emphasizes social network analysis (SNA), focusing on SNA methodology and its application to analyzing wide range of research topics. He published more than 20 peer reviewed articles and several books, such as *Social Network Analysis* (with David Knoke, 2008) and *Social Network Analysis* (with David Knoke, 2020), and *Social Network Analysis: Methods and Examples* (with Franziska Keller and Lu Zheng, 2016).

Chapter 1
Social Network Analysis: An Introduction

Song Yang

Abstract This chapter starts with a brief historical review of Social Network Analysis (SNA), tracing its root to Sociology studies, while emphasizing its strong theoretical motivations. It includes a description of methods, clarifying basic differences between ego-centric and full network analysis. It discusses SNA history and their applications on different subjects. It concludes with a section to discuss the organization of this book, clarifying chapters and their topic coverages.

Keywords Social network analysis fundamentals · Social network analysis theories · Social network analysis histories

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A social network is a social structure made up of a set of social actors (such as individuals, organizations, neighborhoods, parties, or nation/states) and a set of ties, relations, connections, or interactions between those actors. Social network analysis examines social relations, structures, and networks between various social entities such as individuals, teams, groups, parties, organizations, and nation/states [20]. Social network analysis is often defined with technical terms, such as a set of quantitative or qualitative methods being applied to analyzing relations between a set of finite number of cases. However, social network analysis is much more than a set of methodological tools. It builds around three pillars: theory, methods, and applications.

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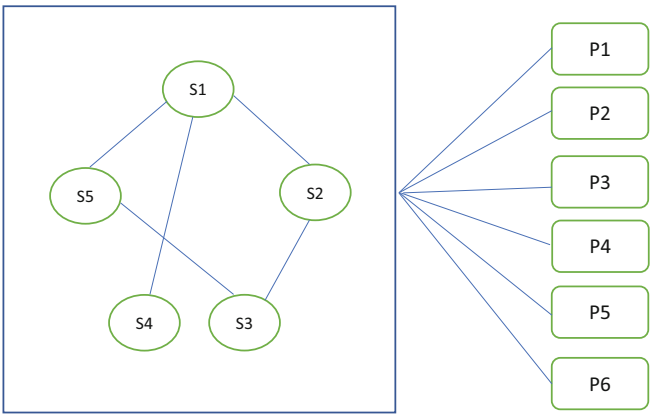
1.1 Social Network Analysis Theories

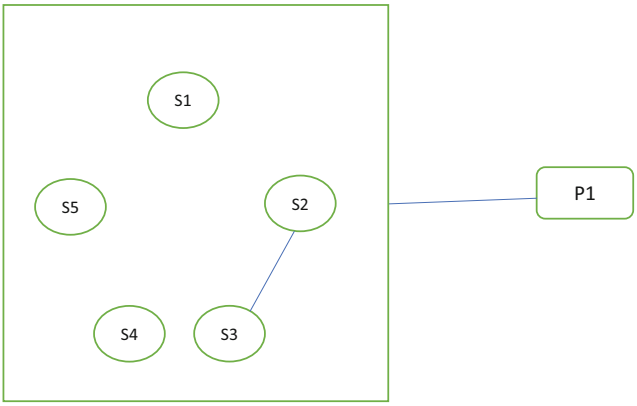
In theory, social network scholars have been very serious about theorical aspects of social networks, focusing on the synergy of the parts and system outcomes at aggregation level. In particular, a simple summation of parts does not produce its arithmetic sum-up at the aggregate level. The systemic outcome of the summation of a social network is either larger or smaller than its arithmetic summation, depending on the relationship between parts. For example, a fruitful collaboration between a set of R & D scientists produce innovative products that none of those scientists could have developed on they own. Conversely, separations or even isolations between members of a group of genius innovators result in low number of innovations being produced. Figure 1.1 illustrates the differences between the two social network configurations and their respective outcomes.

Social network analysis is central ingredient to Mark Granovetter's [11] classical piece on social embeddedness and economic actions, which laid foundation for the neoclassical socioeconomics. Granovetter [11] contended that social network analysis can be used to explain and analyze economic behaviors and actions. In particular, he criticized economics under socialized view of human economic behaviors. He also surprisingly disapproved sociologist over socialized view of human behaviors. He cited Duesenberry's [7] quip that "economics is all about how people make choices, sociology is all about how they don't have any choices to make" to debate that neither approach is ideal to analyze social economic actions ([11]: 485). Social network analysis affords key to avoid the over-socialized view or under socialized view, striking a balance between the two extreme approaches. In particular, social network analysis emphasizes one's individual social contexts in explaining his/her behaviors, avoiding the over socialized view of a sweeping argument that people merely respond to their cultures and norms. Similarly, examining one's social networks also enables researchers to investigate the individual's micro-social environment, avoiding the under socialized view premising on a set of fixed assumptions of human behaviors invariantly applied to all segments of population.

So other than the utility of avoiding over socialized and under socialized view in analyzing social economic behaviors, does social network analysis have any theoretical assumptions on its own? To this, Knoke and Yang [12] discussed three theoretical underpinnings propagating in social network analysis. First, theoretical relations are often more important for understanding observed behaviors than are individual attributes such as, gender, race, age, education occupation, income, and personal temperaments. For example, one's political view is very plastic and difficult to gauge. Often the political views are sets of hybrid forms of beliefs, supports, and agreements that are issue-specific, rather than being strictly partisan that is either all Republican or all Democrats. In addition, the increasing number of undecided voters in key battle ground during crucial elections add tremendous challenges to the task of political analysis. Political scientists have hard time explaining the political views with traditional atomistic variables looking at only the individual attributes (race, gender, social economic status etc). Such challenge compels political scientists to



Active collaborations between scientists produce 6 patented products



Lack of collaborations between scientists leads to low output

Fig. 1.1 Two social networks and their systemic outcomes

look beyond the individual characteristics, taking serious considerations of one's social network. Social network analysis of political actions yields fruitful results. For example, Nickerson [18] reported that each act of voting of an individual on average generates three additional votes from his/her social contacts. Bond et al. [3] conducted a large-scale voter turnout experiment with Facebook platform, reporting that those who received information about their friends' voting via Facebook postings are more likely to vote and to seek political information than those who received none of such information.

Second, social networks affect an individual's perceptions, beliefs, and actions through diverse structural mechanism. For example, the famous thesis of structural holes by Ron Burt [4] asserted that individuals (as well as corporate actors) can

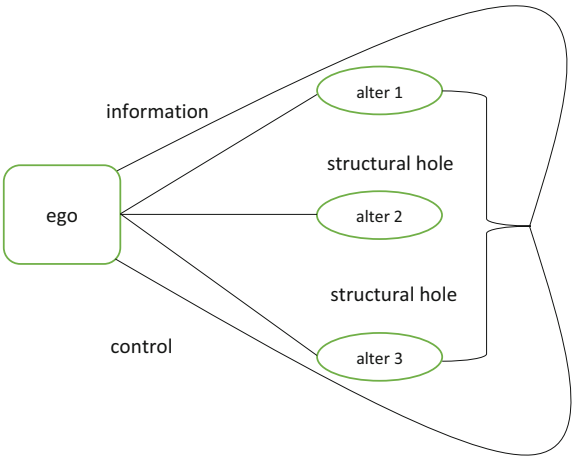


Fig. 1.2 Structural hole and its benefits

benefit from having structural holes in their network configurations via connections to other individuals that are disconnected among themselves. In other words, the disconnected actors provide structural holes, and individuals reap benefits by crossing over such structural holes via connections to those disconnected actors. So, what are those benefits that come with crossing over the structural holes? Per Ron Burt, they are control and information benefits. Compared with individuals who have social closures in their networks, individuals who have structural holes receive novel, additive, and nonredundant information from their diverse sources of network contacts. Individuals who crossover structural holes can also exert control benefits by playing their disconnected contacts off each other, deciding on when and how much information they can brokerage between their contacts. Figure 1.2 displays how the information and control benefits materialize to individuals who crossover structural holes among its social contacts.

However, empirical evidence suggests that the alleged benefits of structural holes only accrue to men, not women [5]. For women, social closures, characterized by strong and redundant ties connecting a cluster of friends afford benefits in the forms of large pay raise and early career promotion. Burt [5] proposed two explanations for such gender disparity: (1) cultural explanation that women tend to thrive in a dense and supportive social environment. While men are very adaptable with leveraging structure holes among their contacts, women may not be comfortable with playing their contacts off each other to exact benefits. (2) institutional explanation that women facing glass ceiling need to bundle together to form a collective force strong enough to break the institutional barrier. Figure 1.3 shows the process whereby social closure, not structural hole affords benefits to women.

Third, the structural mechanism that sustains a network is dynamic, changing, and evolving out of its components' purposive or unpurposive actions. Marriage between two nice couples reflect progressive movement of relationship over time. Unfortunately, a significant portion of marriages ends in divorces between the same nice couples due to relationship deteriorates or other distractions. Inter-