

# Chapter 2

## Social Network

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### ABSTRACT

*Social network concerns the study of the structure of the patterns of relations among social entities. The study of social networks has a long history starting around 1930s when psychologist Moreno conducted the first known sociometric survey. Since then, the field of social network, first developed in sociology, has grown both empirically and theoretically, especially toward the end of the last century. The advent of powerful computing power and the Internet spurred growth on social network research. This combination of the proliferation of digital traces and increases in computing power provides opportunities to study large scale social networks and relevant dynamics.*

### INTRODUCTION

Social network is a pattern of social relations among social entities. Social relations, called *ties*, are represented by lines that connect social entities, called *actors*, to each other and hence create social networks. In general, actors are not necessarily individuals but it can also be social groups, organizations, firms, or institutions. Here, however, we will focus on individuals as actors. In this entry we will provide an overview of social network as a scientific discipline. The intention here is not to provide exhaustive review of the discipline, but to highlight some developments

in the field that are arguably constitute relevant topics for readers who are interested in the study of social behavior in the cyberworld.

We will discuss some structural aspects of social network and then continue to the discussion of dynamical processes on social networks. We differentiate two kinds of structure: local and global network structures. Although this categorization is not mutually exclusive, the distinction between local and global network structures is useful as an analytical leverage to gain insights on how actors, network structure, and dynamical processes are related to each other. When we talk about local structure, our focus is on the impact of network

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structure on an actor or a particular set of actors. The main question here is about how actors' actions, preferences, and information are constrained and enabled by their surrounding networks. When discussing about global structure, on the other hand, the focus is more on the collective-level outcomes from the interaction between dynamical processes and global network structure. We also distinguish two general processes in social networks. The first is what we call as active search. In the active search process, actors actively navigate their social networks to locate and access other actors to obtain information or resources. Active search is also related on the concept of social capital, i.e., how individuals embedded in social network obtain benefits from the network. The second is passive search, in which actors acquire or get infected by information, ideas, beliefs, or behaviors simply because of the fact that they embedded in networks; without actively searching. An example of passive search is social contagion, in which person-to-person influence creates cascade and resulted in social epidemics.

We will start by giving a very brief history of social networks research while introducing some basic terminologies in the field. The goal here is not to give a comprehensive treatment of social network analysis, but just enough so that readers without any prior knowledge about social network can follow this discussion. Then we will proceed to the main body of this entry that comprises four topics: local and global network structure, search problem, and social contagion.

## OVERVIEW

The study of social networks has a long history going back to the 1930s. One of the first research was the study of friendship networks in a school (Moreno, 1934). A more ambitious agenda was initiated around 1950s when political scientist Ithiel de Sola Pool and mathematician Manfred

Kochen launched a research agenda to study social networks; their work published much later in the first issue of the journal *Social Networks* (Pool & Kochen, 1978). Pool and Kochen realized that your friend's acquaintances are as important as your friends themselves, especially in the political milieu as it was Pool's main specialty. Thus, friendship networks largely determine access to political power. In particular, Pool and Kochen were interested in questioning how easy or how difficult individuals could find a social channel that connects them to the power holder. In other words, the question was "what's the probability that two people from different social strata know each other?" The problem of finding political contacts and examining social stratifications can be grouped under one umbrella: the problem of social structure. By initiating this line of research, their goal was to find a way to quantify social structure.

Pool followed the premise that political influence has a positive correlation with the number of contacts one has (i.e., *degree*). Thus, according to Pool, to quantify a person's political influence is to measure how many friends she has. Pool regarded this problem of determining the average degree of individuals as the main problem to solve. Because of limited techniques and computational power available at that time, this task has proven to be hard (for a current attempt to estimate acquaintances volume see McCormick, Salganik, Zheng, 2010).

Even if we get convincing results of individual social network size, however, they still will not give us much information about the network structure. In 1967, Stanley Milgram invented an ingeniously simple method to study social network connection by tracing paths among actors. Milgram described his method, later known as "small world method", as follow:

"My approach was to try to find an experimental method whereby if two persons were chosen at random, it would be possible to trace a line of

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