**Network Analysis in Social and Political Science:**  
**A Short Introduction to Concepts**

**Where do network explanations apply?**  
A formal network analysis perspective can be employed to understand political, economic and social organisations and individuals. The networks examined can be internal or external to institutional context; they can be formal or informal. Social Network Analysis (henceforth SNA) can be employed to:

- examine the interactions between nodes (actors, groups or institutions);
- measure the resource flows between nodes and
- measure the information flows between nodes.

SNA can also provide measures of the structural constraints of actors dependent not only on their own relations but also on the way other actors are related. Embedding actors within the set of their interactions allows for insights on the distribution of power and the effective influence of social and political action.

All social interaction can be viewed in network terms. This is because networks account for the relations between actors. Formal network analysis assists in examining individuals within their institutional context and relational contacts. Indeed some sociologists examine all interactions that relate to individuals, social groups or society as dependent on their networks (see Wellman, 1999).

The approach comprises a *paradigm* in as far as it is based on mathematical foundations of graph theory and the insights allowed by relational theories of social interaction. It is also a *methodology* that can be applied across scientific disciplines and has a well developed set of predominantly descriptive statistics. Most widely used are measures of centrality, density, transitivity, reciprocity and brokerage. Measures also examine the way groups cohere, fraction or cluster. Hundreds of algorithms are available for the examination of network properties (see the attached list of software).

Network analysis is ‘peculiar’ in that it requires a special set of statistical tools for constructing tests of significance. This is because as a method it violates an elementary principle of statistical inference, namely of *independent observations*. The use of simulation techniques either through ‘bootstrapping’ or through Monte Carlo Markov Chains often provides the background to a more rigorous hypothesis testing of network properties.

SNA can be employed along other methodology tools in the study of political institutions and actors. It easily complements more traditional qualitative and quantitative techniques and is conducive to method triangulation.

**Examples of the use (and misuse) of networks**  
The study of *social movements* has benefited from a relational perspective where collective action is viewed to be dependent on the social context and the transitive ties of individual actors. In the edited volume by Diani and McAdam (2002) the role of individual and inter-organisational networks as well as the relevance of networking in
the political process. In the conclusion Diani associates collective dynamics with network structure.

The study of ‘policy networks’ as proposed in an influential series of articles/volumes commencing with Marsh and Rhodes in 1992 has been detrimental to the field of SNA. Poor understanding of the implications of relational dynamics implied a number of fundamental errors and generalisations. Actors in a network are assumed not bound by the fundamental laws of relational space such as horizons, clusters, centrality and reputation. Networks are in effect employed as a heuristic devise and do not denote structured relational ties. That literature better fits in the epistemic communities genre (a critique in Christopoulos, 2006).

The most influential current accounts on social capital entail a network dynamic. Nan Lin (2001) is the most often cited example where social capital advantages are operationalised with reference to the ‘strength of weak ties’ and ‘structural holes’ in the social fabric. The debate has affected public bodies such as the OECD and the British Office of National Statistics that have included network questions in a number of their surveys that attempt to measure trust. (see: http://www.esds.ac.uk/Government/docs/soccapguide.pdf)

Lately the examination of virtual communities and the emergence of the so called ‘denizen’ (digital citizen) are based on the examination of network interactions within the information super-highway. (see Adamic and Glace, 2005).

Comparison of business and marriage ties of 15th c. Florentine families.

![Graph of Florentine families](image)

Note: The Medici and the Strozzi are vying for control of Florentine politics in the 15th c. The graph presents a good indication of which actors are central and which play a bridging role. Node size indicates relative wealth. For an intricate picture of the multitude of relationships recorded for the 92 important families see Breiger and Pattison (1986).

Network analysis can also be employed to entertain. The now infamous ‘Oracle of Bacon’ has spurned an Oracle of Elvis and an Oracle of Arnie (check: http://www.cs.virginia.edu/oracle/). For network art with a political message check the work of Mark Lombardi: http://www.wburg.com/0202/arts/lombardi.html.
The network perspective has very productive sub-fields within historical anthropology, development studies, epidemiology and so on. The methodology can be traced to graph theory in mathematics and the use of sociograms by psychologists and anthropologists in the 1930s. (See Freeman, 2004 for the definitive ‘history’ of the field)

**Elementary concepts**
As with all social research a network perspective is limited by the data gathering tools available. Usually therefore although networks have to be presumed relatively fluid data can only give a temporal snap-shot picture. The dearth of longitudinal data in the social network perspective is balanced by a series of methodological tools that allow the analysis of patterns (or regularities) in underlying relationships of interacting units.

According to Wasserman and Faust (1994, pp 17-21) ‘a social network consists of a finite set or sets of actors and the relation or relations defined on them. The presence of relational information is a critical and defining feature of a social network’.

**Terminology related to graph theory:**

- ‘Actors are discreet individual, corporate, or collective social units’ this ‘does not imply that these entities necessarily have volition or the ability to “act”’.

- ‘Actors are linked to one another by social ties’.

- ‘At the most basic level. A linkage or relationship establishes a tie between two actors. This is called a dyad.’

- A subset of three actors is called a triad.

- A subgroup of actors is any subset of actors.

- ‘A group is the collection of all actors on which ties are to be measured’ in other words a system of actors.

- ‘The collection of ties of a specific kind among members of a group is called a relation’.

A number of important principles distinguish network analysis from all other related social science. They are according to Wasserman and Faust (1994, ch1):

- Actors and their actions are viewed as interdependent rather than independent, autonomous units
- Relational ties (linkages) between actors are channels for transfer or ‘flow’ of resources (either material or nonmaterial)
- Network models focusing on individuals view the network structural environment as providing opportunities for or constraints on individual action
- Network models conceptualise structure (social economic, political and so forth) as lasting patterns of relations among actors.
Data types in social and network research

Attribute data ‘relate to the attitudes opinions and behaviour of agents, in so far as these are regarded as the properties, qualities or characteristics which belong to them as individuals or groups’ (John Scott, 1991, p.2-3). Attribute data will be measured as values of particular variables i.e. income, education etc.

Relational data ‘are the contacts, ties and connections, the group attachments and meetings, which relate one agent to another and so cannot be reduced to the properties of the individual agents themselves. Relations are not the properties of agents, but of systems of agents; these relations connect pairs of agents into larger relational systems’ (Scott, op.cit.). By using network analysis we attempt to put values on relations within networks which are inherently qualitative measures of network structure.

Ideational data ‘describe the meanings, motives definitions and typifications themselves. Techniques for the analysis of ideational data are less well developed than those for attribute and relational data’ (Scott, op.cit.)

The three types of data are often collected alongside one another as aspects of the same investigation. Questionnaires, interviews, participant observation, communication monitoring, documentary investigations, archival investigations can all be relevant sources of data generation. The examination of relational (network) data is not incompatible to employing actor attribute data in the same analysis.

SNA provides a powerful tool for the graphic representation of relations. It allows for both an intuitive and a statistically strong analysis. It pertains to both actor and systemic factors. It allows for the examination of events in tandem with actors.

Structure and Agency: Networks allow for the integration of structure and agency: a structural perspective integrated into an agent’s relational ties (Christopoulos, 2006). Network structure affects what is possible in terms of resource dissemination or flows of information.

Fundamental premises in SNA
a. Network Boundaries
   Six Degrees and other myths: being connected does not imply interacting, while interaction does not imply support
b. Network Horizon
   Two to three degrees of effective influence, resource base probably wider
c. Maintaining network ties
   100 to 200 strong ties: there is a limit to effective networking; maintaining ties entails a cost in resources
d. How many ties in a lifetime?
   +2000 ties per person
e. Transitivity
   two actors with strong ties to a third actor are likely to be strongly tied to each other
f. **Centrality**  
   a good predictor of power and status

g. **Brokerage**  
   a good predictor of the opportunity for taking advantage of ‘structural hole’ benefits; this is sometimes associated with entrepreneurial gain

Are Network Theory Assumptions Intuitive?

*If you will look for networks you will find them everywhere* so uncritical use of the notion of networks has little explanatory power

Yet: stating that networks exist is similar to stating that society exists. It is a mapping of social structure and an understanding of agent motives and opportunities that allows us to claim an understanding of society.

**Graph representation affects our perception of power and hierarchy**

Note: Algorithms from Pajek were employed to generate and draw this random graph. Assessments of influence can be affected by the depiction of social space.

**A terrorist network: Ties between the perpetrators of 9/11**


“I was amazed at how sparse the network was and how distant many of the hijackers on the same team were from each other. Many pairs of team members were beyond the horizon of observability (Friedkin, 1983) from each other - many on the same flight were more than two steps away from each other. A strategy for keeping cell members distant from each other, and from other cells, minimizes damage to the network if a cell member is captured or otherwise compromised.”
Combat Networks?
"networks are indispensable to the defense of the United States. In addition, there is no science today that offers the fundamental knowledge necessary to design large, complex networks in a predictable manner" from the abstract of the latest US army report on the importance of networks for defence. [http://www.nap.edu/catalog/11516.html](http://www.nap.edu/catalog/11516.html)

Counterintuitive Networks?

‘the strength of weak ties’ distant ties are more important for finding resources or information than closer ties; redundancy in agent ties is not effective for locating scarce resources (Mark Granovetter, 1973) but can be effective for creating other intangibles such as social bonds and social capital

therefore: being connected through a wide range of others (low redundancy in your ties) can have resource payoffs

‘structural holes’ and the payoffs for brokers, consultants and gatekeepers: chances for gain are created by the ability to bridge holes between agents that are not connected (Ronald Burt, 1992)

therefore: the roles of intermediaries and the ability to connect different (or even hostile) networks has the potential for high payoffs

but: Borgatti (1997) has found tools employed in structural holes research to fail to account for 2nd order relations (i.e. a measure of connectedness similar to ‘weak ties’).

US Carter administration recorded meetings between Cabinet members

Note: Graph on the left depicts meetings in the first year of the Carter administration. The President is no longer the central node. Actors in the executive have found ways to bridge the structural holes.