

Social Power: Network Centrality

Leonid E. Zhukov

School of Applied Mathematics and Information Science
National Research University Higher School of Economics

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НАЦИОНАЛЬНЫЙ ИССЛЕДОВАТЕЛЬСКИЙ
УНИВЕРСИТЕТ

Sociology. Linton Freeman, 1979.

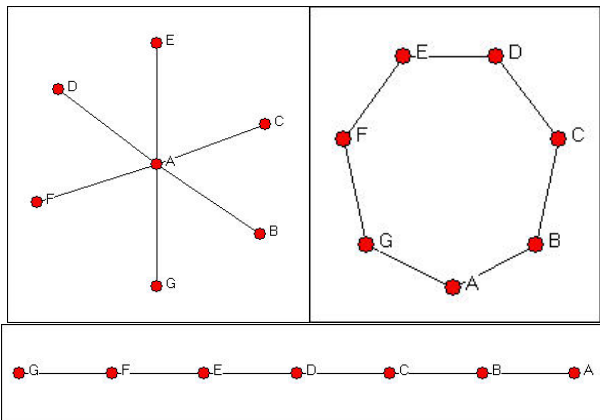
Most "important" actors: actor location in the social network

- Actor Centrality - involvement with other actors, many ties, source or recipient
- Actor Prestige - recipient (object) of many ties, ties directed to an actor

Three graphs:

- Star graph
- Circle graph
- Line graph

Three graphs



Degree Centrality

$$C_D(i) = k(i) = \sum_j A_{ij} = \sum_j A_{ji}$$

Normalized degree centrality

$$C_D^*(i) = \frac{1}{n-1} C_D(i)$$

High centrality degree - direct contact with many other actors

Low degree - not active, peripheral

Closeness Centrality

How close an actor to all the other actors in network

$$C_C(i) = \left[\sum_j d(i,j) \right]^{-1}$$

Normalized closeness centrality

$$C_C^*(i) = (n - 1)C_C(i)$$

Actor in the center can quickly interact with all others, short communication path to others, minimal number of steps to reach others

Betweenness Centrality

Betweenness Centrality

Number of shortest paths going through the actor $\sigma_{st}(i)$

$$C_B(i) = \sum_{s \neq t \neq i} \frac{\sigma_{st}(i)}{\sigma_{st}}$$

Normalized betweenness centrality

$$C_B^*(i) = \frac{2}{(n-1)(n-2)} C_B(i)$$

Probability that a communication from s to t will go through i (geodesics)

Edge betweenness

Degree Prestige

$$P_D(i) = k_{in}(i) = \sum_j A_{ji}$$

Normalized degree prestige

$$P_D^*(i) = \frac{1}{n-1} P_D(i)$$

Prestigious actors receive many nominations

Proximity Prestige

Influence domain - set of actors that can reach i directly and indirectly.

l_i - size of influence domain. Average distance $\sum_j d(j, i)/l_i$

$$P_p(i) = \frac{l_i/(n-1)}{\sum_j d(j, i)/l_i}$$

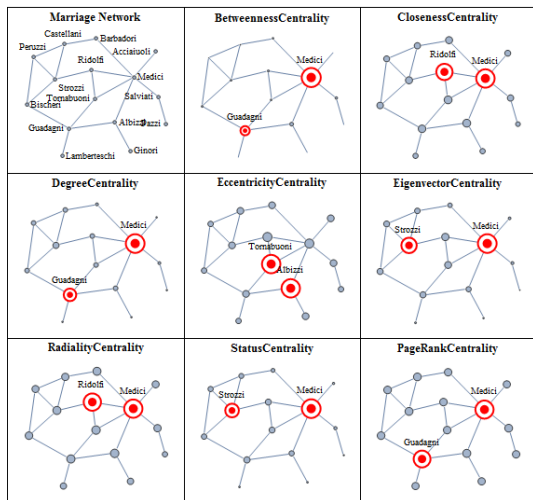
Centralization - how central the most central node in relation to all other nodes.

$$C_x = \frac{\sum_i^N [C_x(p_*) - C_x(p_i)]}{\max \sum_i^N [C_x(p_*) - C_x(p_i)]}$$

C_x - one of the centrality measures

Centrality and Prestige of Florentine Families

The Medici family marriage network



- Centrality in Social Networks. Conceptual Clarification, Linton C. Freeman, *Social Networks*, 1, 215-239, 1979
- Power and Centrality: A Family of Measures, Phillip Bonacich, *The American Journal of Sociology*, Vol. 92, No. 5 (Mar., 1987), 1170-1182.