Triads

A basic unit of social network theory and analysis is the *dyad*, or pair of parties who may or may not share a social relation with one another. A *triad* is a set of three parties, which also consists of three dyads. In his seminal work, Georg Simmel argued that triads are a fundamental unit of sociological analysis. He argued that three actors in a triad may allow qualitatively different social dynamics that cannot be reduced to individuals or dyads. For example, among three parties A, B, and C, party A may have a dyadic relation to C but also may have an indirect relation to C through B. Party B may then serve to alter the strength or the nature of the relation between A and C, such as solidifying an alliance or mediating a conflict. If A and C do not interact directly, party B may broker a transaction between them and may derive power from this intermediary position.

A principal interest in the study of triads is the phenomenon of transitivity. A triad is transitive if when there is a tie from party A to party B and from B to a third party C, then there is also a tie from A to C. If the A-B and B-C ties both exist, but A is not tied to C, then the triad is intransitive. (This condition must be checked for any assignment of the labels A, B, and C to the three parties.) Transitivity is typically studied for *directed* relations, where a tie *from* A *to* B (denoted A→B) is directional and does not imply the same relation from B to A. For directed networks, if the A→B and B→C ties both exist, but A→C does not, then the triad is intransitive. Some directed relations have a pervasive tendency toward transitivity: If A dominates B and B dominates C, then A is also likely to dominate C. Some undirected relations also tend to be transitive, as represented by the adage, 'a friend of a friend is a friend.' Triads for some other relations – notably romantic ties between lovers – are overwhelmingly intransitive.

Simmel also argued that triads may serve as an analytical foundation for understanding larger social groups. Decades of work have thus analyzed the structure of networks by measuring the distribution of relations at the triadic level. Researchers have enumerated all qualitatively distinct sets of relations for triads in a given network. Such a "triad census" has been employed to assess an overall tendency toward sociability, hierarchy, or transitivity in large social networks, and formed an early foundation for statistical network analysis.

Dynamics of Triads

In models of network evolution, scholars often assume a direct propensity to close triads. Structural Balance Theory offers a motivational account for triad closure in *signed networks*, where the relation between two actors may be positive or negative. Specifically, disagreement between positively-tied friends (or agreement between negatively-tied enemies) leads to psychological tension, fostering a drive among the parties to resolve this dissonance. In a friendship triad, when a friend of a friend is an enemy, then either the enemy will become a friend or one of the friends will become an enemy, to resolve tension in relations.

Recent work has challenged Simmel's emphasis on the triad as an irreducible lens for analyzing social dynamics. Work in agent-based modeling has demonstrated that pervasive patterns in distributions of triads (such as transitivity) may be partly or wholly byproducts of social dynamics in dyads. A dyadic propensity toward homophily (e.g. choosing friends who are in the same social categories as you) will tend to foster transitivity, even if actors have no direct propensity to close triads. For example, in a relatively small group of engineers and lawyers, if engineers prefer other engineers as friends while lawyers prefer other lawyers, then this generates a tendency toward transitivity. In the extreme, all engineers will be friends with all engineers and all lawyers will be friends with all lawyers, and so all triads will be closed without any direct propensity to do so. Empirical research considering homophily and triad closure

simultaneously – employing *exponential-family random graph models* (ERGMs) – suggests that these dynamics are mutually entangled. This interdependence of social dynamics at the dyadic and triadic levels requires a greater sophistication both in theories and in statistical models of network evolution.

Implications

Regardless of the social processes generating observed patterns in triads, those patterns have substantive implications for the dynamics of groups, organizations, and markets. For example, James Coleman argued that closure in triads leads to interpersonal trust, greater cooperation, and enforcement of norms. This dynamic can be generalized to larger networks, offering predictions for the level of cooperation in groups as a function of network structure.

Mark Granovetter posited that transitivity is more pervasive in triads linked by strong ties (than in triads linked by weak ties), resulting in dense clusters of strongly-tied actors with weak ties reaching beyond local clusters. He thus argued that weak ties convey more novel information between clusters. Ronald Burt developed a theory of 'structural holes,' elaborating on strategic advantages of occupying a network position along such paths. Both derive important high-order consequences from patterns at the triadic level.

See Also: ERGM (p*); Homophily; Network Evolution; Signed Networks; Structural Holes; Tie Strength

Authored by: James A. Kitts, Columbia University
Jun Huang, Columbia University

Cite As: Kitts, James A. and Jun Huang. 2010. "Triads." *Encyclopedia of Social Networks*, George Barnett, Editor. New York: Sage Publications.

Further reading

Burt, R. (2005). *Brokerage and Closure: An Introduction to Social Capital.* New York, Oxford University Press.

Coleman, J. (1990). *Foundations of Social Theory*. Cambridge, MA, Harvard University Press.

Goodreau, S., Kitts, J. and M. Morris. "Birds of a Feather or Friend of a Friend? Using Exponential Random Graph Models to Investigate Adolescent Friendship Networks." *Demography* 46(1):103-126, 2009.

Granovetter, M. "The Strength of Weak Ties." *American Journal of Sociology* 78: 1360-1380, 1973.

Simmel, G. *The Sociology of Georg Simmel*. The Free Press, New York, 1908/1950.

Wasserman, S and K. Faust. "Structural Balance and Transitivity." Pp, 220-248 in *Social Network Analysis: Methods and Applications*. New York: Cambridge University Press, 1994.