INSNA SUNBELT 2009 Session Papers: Kinship Network Analysis. Chairs: Doug White, Klaus Hamberger
Session Abstract: New approaches and new software algorithms for kinship network analysis and K-cohesion in social networks.

K-cohesion and emergent causality in kinship and social networks – Doug White
University of California, Irvine.

For kinship and social networks k-cohesive groups are well defined k-component subnetworks: (1) not separable except by removal of k of their nodes; (2) wherein each pair of nodes has a minimum nonnegative integer k of connective paths that have no intermediate nodes in common. Menger proved that these two properties are equivalent. The *ck* number of each node in a network is the maximum *k* for its memberships in k- components. Cohesive embeddings and scalability are properties of the k-cohesion model; k-cohesive groups may overlap and necessarily have inclusion relations within those with lesser values of k. Applied to empirical data—such as the San Juan Sur SJS families—the models entail potentials for cooperation and thresholds of emergent causality. Tests of general hypotheses about emergent causality in relation to k-cohesive groups and ck-numbers of nodes within various types of networks – friendship, business, kinship and networks with oppositional conflicts - support the theoretical utility of this measurement framework. In the SJS data, for example, higher interfamily visiting cohesion correlates with locally judged social class ranking. Prospectively, small-group experiments are planned to aid in measuring the effects of differing cohesive embeddings.

Multiplication of networks in kinship analysis – Andrej Mrvar, Vladimir Batagelj
University of Ljubljana, Slovenia

The product of compatible networks is determined by nonzero elements of the matrix of the product of matrices corresponding to the given networks.
Considering only non-zero elements of matrices gives a fast algorithm for multiplication of sparse networks. We derived also some simple conditions that the product of two sparse networks is sparse itself.
One application of product of networks is computation of different derived kinship relations (uncle, grandmother, niece, ...) in genealogies. This enables us to analyze the structure of genealogies with respect to these relations.
Multiplying a vector with a sequence of kinship relations we can also efficiently count how many times a person is in selected kinship relation with other members of genealogy.
The proposed approaches will be illustrated with analyses of some well known genealogies (Turkish nomads, Ragusa, ...)

Reference: Batagelj, V, Mrvar, A. 2008. Analysis of Kinship Relations with Pajek,
Social Science Computer Review 26(2): 224-246.

Cycle search in kinship networks – Klaus Hamberger, Centre d'études des mondes africains (CNRS), Paris.

The paper presents concepts and methods of cycle classification and cycle search in kinship networks. Concepts include the core notion of "matrimonial ring" as discussed in more detail in the Sage handbook article on "kinship networks" (Hamberger, Houseman and White, forthcoming). Algorithms discussed are used by the computer program Puck (Program for the use and computation of kinship networks, downloadable at www.kintip.net) developed by the TIP/Kinship and Computing research group (Paris). The paper presents a two-stage process of exhaustive matrimonial ring search; in particular for marriage relinkings where the problem of isomorphic cycles arises (simple blood marriage cycle search is almost trivial). In a first stage, a table of unspecified consanguinity relations is established; in a second stage, these relations are used, together with marriage ties, to construct all possible closed chains of relinked couples, isomorphic chains being avoided from the outset. Consanguinity chains are specified in the course of the construction. The advantages and disadvantages of this method (in comparison to matrix multiplication as used by Pajek and one-stage DFS methods as used by Genos) as well as implementation issues are discussed. The method is demonstrated using both large kinship networks (up to 30.000 vertices) and very dense ones (up to 200 3rd cousins per vertex).

Analyzing networks by networks: ring intersection graphs as a tool for exploring matrimonial structures – Isabelle Daillant, Laboratoire d'ethnologie et de sociologie comparative, Nanterre.

The paper develops the idea of analyzing the cycle (ring) structure of kinship networks by means of second-order networks, where vertices represent types of marriage cycles and edges represent frequencies of intersections (coincidence of marriage edges) of cycles of different types. Such "ring intersection networks", providing insight into the topology of cycle sets, can be a useful tool for exploratory analysis. By indicating the frequencies of marriages that form part of rings of two different types, or which form part of rings of one but not of another type, they reveal the interdependencies of marriage types. On the one hand, matrimonial ring intersection may be the direct effect of a social norm (e.g. a preference for bilateral cross cousin marriage, which implies simultaneous matri- and patrilateral cross cousin marriage), on the other hand, it may emerge as an indirect effect of ring combination in dense networks (e.g. a high frequency of marriages with sister's daughter increases the probability of patrilateral cross cousins being at the same time maternal aunts). Proper understanding of these interdependencies is essential for the analysis of matrimonial systems. The paper discusses the mechanisms that give rise to them, and some network analytic methods for studying them. Examples are drawn from several Amazonian societies, using Puck and Pajek software.

Reference: Daillant, Isabelle. 2003. *Sens Dessus Dessous: Organisation Sociale et Spatiale Des Chimane D'Amazonie Bolivienne*. Société d'ethnologie, Paris.