Cluster: Tools and models

Project 2: Subgroups in dynamic social networks

Aim
Development and application of statistical models for emergence, composition change, and dissolution of cohesive subgroups in a wider social network context.

Theoretical background
Many social networks tend to self-organise into smaller units which can be defined mathematically as *cohesive subgroups*, subsets of social actors that are more connected inside their group than to other groups. In many applied settings, cohesive subgroups play an important intermediate-level role between the individual network member and the total network. For example, peer influence processes typically take place on the subgroup level.

While subgroups are an emergent outcome of network change processes, techniques for the assessment of subgroups are typically decoupled from the statistical modelling of network dynamics. Among the multitude of existing community detection methods (e.g., Fortunato, 2010), only a few address the case of longitudinal data, and none of them is integrated with tools that would allow statistical inference about subgroup-specific processes. In consequence, the subgroup concept remains difficult to work with for researchers who might want to apply it in their research, e.g., when studying adolescent development or intra-organisational networking.

In this project, statistical models are developed that render the subgroup concept operational for applied social science research. Theories about subgroup formation as well as theories about subgroup-specific behaviour this way should become empirically testable.

Research design
In the first phase of the project, statistical models for emergence, composition change, and dissolution of cohesive subgroups in a wider social network context will be elaborated, representing the self-organised nature of these subgroups. To this end, latent class models of subgroup membership and bipartite network models of subgroup affiliation will be formulated as elaborations of existing stochastic actor-based network evolution models (Snijders, van de Bunt & Steglich, 2010).

In the second phase, these models will be combined with models for subgroup-specific processes. Examples would be the hierarchical self-organisation of network ties inside subgroups, effects of subgroup structure on individual-level outcomes, or the comparison of peer influence processes that occur within versus between subgroups.

Throughout the project, existing longitudinal network data from different sources and research contexts will be used. The models developed in this project will be implemented as part of the RSiena software. The ideal candidate has an interest in social science network research, some background in statistical modelling, and some experience with programming.

Literature
Fortunato, S. (2010). Community detection in graphs. *Physics Reports*, 486(3), 75-174.
Snijders, T. A.B., Van de Bunt, G. G., & Steglich, C. E.G. (2010). Introduction to stochastic actor-based models for network dynamics. *Social Networks*, 32, 44-60.

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Location
Groningen