SOE 20: Social Systems, Opinion and Group Dynamics III

Time: Thursday 14:00–15:15 Location: H 0110

SOE 20.1 Thu 14:00 H 0110

Fragmentation Transitions in Multi-State Voter Models — •Gesa A. Böhme[1] and Thilo Gross[2] — [1]Max-Planck-Institute for the Physics of Complex Systems, Dresden, Germany — [2]University of Bristol, Department of Engineering Mathematics, Bristol, UK

Adaptive networks can display fragmentation transitions, where the network breaks into disconnected components. Fragmentation transitions frequently occur in models for opinion formation. We investigate opinion formation in a model society with N opinions. Voters in this model align with their social environment or cut relationships to disagreeing individuals according to given rates. The system can reach different regimes, which are characterized by their number of disconnected components, ranging from 1 (full consensus) to N (full fragmentation). Transitions between these regimes, i.e. the fragmentation thresholds, depend on the parameters of the system. In this talk we give an analytical estimation of the fragmentation thresholds for the example of three opinions, and generalize the results to models with an arbitrary number of opinions. Based on eigenvalue bounds, we reveal equivalence principles for special state-network topologies which allow for a significant reduction of the parameter space.

SOE 20.2 Thu 14:15 H 0110

Early fragmentation in the adaptive voter model on directed networks — •Gerd Zschaler[1], Gesa A. Böhme[1], Michael Seissinger[1], Cristián Huepe[2], and Thilo Gross[3] — [1]Max-Planck-Institut für Physik komplexer Systeme, Dresden, Germany — [2]614 N. Paulina Street, Chicago IL 60622-6062, USA — [3]University of Bristol, Bristol, UK

We consider voter dynamics on a directed adaptive network with fixed out-degree distribution. A transition between an active phase and a fragmented phase is observed. This transition is similar to the undirected case if the networks are sufficiently dense and have a narrow out-degree distribution. However, if a significant number of nodes with low out-degree are present, then fragmentation can occur even far below the estimated critical point due to the formation of self-stabilizing structures that nucleate fragmentation. This process may be relevant for fragmentation in current political opinion formation processes.

SOE 20.3 Thu 14:30 H 0110

Single vs multiple source mechanisms in social diffusion — •Paula Tuzón Marco, Víctor M. Eguíluz, and Maxi San Miguel — IFISC (UIB-CSIC), Palma de Mallorca, Spain

Diffusion processes in social systems, such as rumours, fashions, innovations or opinions, are typically modeled following two different mechanisms: one based on epidemic-like spreading models and the other on threshold models. The main difference lies in the number of sources involved for an agent to adopt; while in the epidemic-like models, a single source is enough to trigger contagion, in threshold models, multiple sources are necessary to convince an individual, and the threshold refers to the number of signals that an agent has to receive to adopt. Despite the theoretical work, it is not clear which approach is closer to the empirical evidence. For instance, how the probability for a consumer to buy a new product depends on the number of neighbours buying this product? In this work, we propose a model that interpolates between single and multiple signal integration in a certain window, and explore how both mechanisms affect the adoption curve and cascades.

SOE 20.4 Thu 14:45 H 0110

Opinion diffussion on commuting populations — •Juan Fernández-Gracia, Víctor M. Eguíluz, and Maxi San Miguel — IFISC, Instituto de Física interdisciplinar y Sistemas Complejos (CSIC-UIB), Campus Universitat Illes Balears, E-07122 Palma de Mallorca, Spain

We model a network of interaction having into account explicitly commuting patterns, which accounts for most intracity mobility, and explore the effect of this interaction network on the dynamics of opinion competition. In particular we make use of a simple agent based model (the voter model) in which agents can have one of two equivalent opinions and they update their opinion by copying the opinion of another agent they come in touch with. Referring to the network of interaction, we have a substrate of cities and certain fluxes of commuting agents between them. We measure analitycally and numerically the impact on the evolution of the global opinion of different topologies such as lattices in one and two dimensions with (a) heterogeneous populations and (b) commuting patterns. Furthermore we asses the impact of the strength with which populations are mixed, which is a tunable parameter in the model.

SOE 20.5 Thu 15:00 H 0110

Interdependent choices under social influence — •Ana Fernández del Río, Elka Korutcheva, and Javier de la Rubia — Departamento de Física Fundamental (UNED), Madrid, Spain

Mean-field Ising equilibrium dynamics can be used to describe the collective properties of certain choice or decision making processes when we want to mimic a generic tendency of individuals to conform to the norm, understood in this case as the accurately perceived average behaviour of the group [2,3,4]. Even very simple models already have interesting interpretations in social contexts and direct parallelisms can be drawn between them and some utility maximising scenarios from traditional discrete choice theory in the social sciences literature [1]. Besides, they provide a framework in which to naturally introduce heterogeneity, characterising the group through probability distributions describing individual attitudes towards the particular choice. The study of the system at finite temperature allows for the consideration of fluctuations varying in time, which can encode lack of information or a more fundamental uncertainty on human nature concerning free will.

The use of two coupled Ising models to describe a group where individuals have to make two choices which affect each other is discussed, and the system's phase diagrams for some particular cases in the light of binary interdependent decisions described.

[1] Durlauf. PNAS, 96:10582-10584, 1999. [2] Föllmer. J.Math.Econ., 1:51-62, 1974. [3] Galam. Phys.A, 238:66-80 ,1997. [4] Gordon, Nadal, Phan and Semeshenko. M3AS, 19(1):1441-1481, 2008.