BP 10: Evolutionary Game Theory I (joint SOE, BP)

Time: Tuesday 9:30–11:00 Location: H44

Invited Talk BP 10.1 Tue 9:30 H44

Humans playing spatial games — •Arne Traulsen — Max-Planck-Institute for Evolutionary Biology, 24306 Plön, Germany

Probably the most thoroughly studied mechanism that can explain the evolution and maintenance of costly cooperation among selfish individual is population structure. In the past years, hundreds of papers have mathematically modeled how cooperation can emerge under various dynamical rules and in more and more complex population structures [1]. However, so far there is a significant lack of experimental data in this field. We have conducted an experimental test to address how humans are playing a particularly simple spatial game on a regular lattice [2]. The data shows that the way humans choose strategies is different from the usual assumptions of theoretical models. Most importantly, spontaneous strategy changes corresponding to mutations or exploration behavior is more frequent than assumed in many models. This can decrease the influence of some spatial structures. This experimental approach to measure properties of the update mechanisms used in theoretical models may be useful for mathematical models of evolutionary games in structured populations.

[1] Szabó and Fáth, Evolutionary games on graphs, Physics Reports 446:97-216 (2007)

[2] Traulsen, Semmann, Sommerfeld, Krambeck, and Milinski, submitted

BP 10.2 Tue 10:00 H44

Coordination with switching costs: A case for percolation in socioeconomic networks — •Carlos P. Roca[1], Moez Draief[2], and Dirk Helbing[1,3] — [1]Chair of Sociology, in particular of Modeling and Simulation, ETH Zurich, Switzerland — [2]Intelligent Systems and Networks Group, Imperial College London, UK — [3]Santa Fe Institute, USA

Coordination is ubiquitous in social and economic interactions [1,2]. An important but not much studied issue is the influence of the costs involved in the switching of strategy, which however can be very relevant to important situations such as inefficient norms [3] or competition in technological markets [4]. We propose an extension of a binary coordination game to investigate this problem. We study it on degree-homogeneous random networks, observing that the outcome is greatly influenced by the underlaying network. The dependence on the network degree is highly non-trivial and extremely large degrees are needed to recover the mean field results. The explanation of this unexpected behavior resides in a particular kind of percolation process that takes place in the networked population. These results strongly suggest that percolation phenomena may be crucial in social and economic networks when coordination interactions are in play.

[1] Lewis, Convention: A Philosophical Study, Harvard University Press, 1969 [2] Harsany and Selten, A General Theory of Equilibrium Selection in Games, MIT Press, 1988 [3] Mahoney, Theory and Society 29, 507-548, 2000 [4] Klemperer, The Review of Economic Studies, 62, 515-539, 1995

BP 10.3 Tue 10:15 H44

Rock-papers-scissors dynamics on complex networks — Markus Schütt and •Jens Christian Claussen — Inst. f. Neuro- und Bioinformatik, Universität zu Lübeck

Cyclic coevolutionary dynamics of three cyclically dominating strategies have been found in Prisoner's Dilemma conflicts (with AllC, AllD and TFT) as well as in bacteria (E.coli) and the lizards (Uta stansburiana). The simplest payoff matrix resembling this cyclicity is that of the rock-papers-scissors (RPS) game. The meanfield dynamics of such cyclic coevolutionary dynamics in finite population has been analyzed in previous work for the RPS game [1] as well as for a bimatrix game played between two populations [2]. Here we investigate the fixation time for the RPS game on different types of regular, random, small-world and scale-free graphs [2].

[1] JC Claussen and A Traulsen, Phys. Rev. Lett (2008)
[2] JC Claussen, Eur. Phys. J. (2007)
[3] M Schütt and JC Claussen (in preparation)

BP 10.4 Tue 10:30 H44

Evolutionary games in the multiverse — •Chaitanya S. Gokhale and Arne Traulsen — Max-Planck-Institute for Evolutionary Biology, August-Thienemann-Straße 2, 24306 Plön, Germany

Evolutionary game dynamics of two players with two strategies has been studied in great detail. These games have been used to model many biologically relevant scenarios, ranging from social dilemmas in mammals to microbial diversity. Some of these games may in fact take place between a number of individuals and not just between two. Here, we address one-shot games with multiple players. As long as we have only two strategies, many results from two player games can be generalized to multiple players. For games with multiple players and more than two strategies, we show that statements derived for pairwise interactions do no longer hold. For two player games with any number of strategies there can be at most one isolated internal equilibrium. We show that for any number of players d with any number of strategies n, there can be at most $(d-1)^{n-1}$ isolated internal equilibria. Thus, multiplayer games show a great dynamical complexity that cannot be captured based on pairwise interactions. Our results hold for any game and can easily be applied for specific cases, e.g. public goods games or multiplayer stag hunts.

BP 10.5 Tue 10:45 H44

Social Dilemmas for Players with Complex Personality Profiles — Tadeusz Platkowski and •Jan Zakrzewski — Deparment of Mathematics, Informatics and Mechanics, University of Warsaw

We develop a theory of evolution of social systems based on the imitation rule which generalizes the standard proportional fitness rule of the evolutionary game theory. The formalism is applied to describe the dynamics of various types of social dilemma games played in infinite populations. In particular the theory predicts the non-zero level of cooperation in the long run for the Public Good games, the existence of the nonunique stable polymorphism for particular classes of the Prisoner's Dilemma games, and stable asymptotic cooperation level for coordination games in the N-person setting, for which the standard replicator dynamics approach predicted the instable polymorphism.