# AGSOE 9: Economic Models and Evolutionary Game Theory I

Time: Tuesday 14:00–16:00 Location: BAR 205

AGSOE 9.1 Tue 14:00 BAR 205

**Predicting social systems** — •Eckehard Olbrich, Nils Bertschinger, and Jürgen Jost — Max Planck Institute for Mathematics in the Sciences, Leipzig, Germany

Predicting social systems can, unlike in natural systems, evoke reactions that affect the predicted outcome. One well-known example are the so called "Self fulfilling prophecies". We analyze this phenomenon in a game theoretic setting. In a game with uncertainty an additional player is introduced who can ask the players before the actual game about their intentions and is interested in a prediction being as good as possible. We analyze under which conditions this modification introduce new equilibria to the game and discuss possible applications such as election polls or analyst forecasts.

Finally it is discussed to which extent the explanation of "self-fulfilling prophecies" has to take into account not only strategic interactions as it is formalized in the game theoretic approach, but also cognitive aspects, such as the framing of the situation.

AGSOE 9.2 Tue 14:30 BAR 205

**Coarse-graining of evolutionary models** — •Johannes Höfener — Biological Physics Section, Max-Planck Institut für Physik komplexer Systeme, Nöthnitzer Straße 38, 01187 Dresden, Germany

Analyzing complex evolutionary agent-based models by simulations can become prohibitively numerical demanding. Here we present a coarse-graining method, which uses only short burst of agent-based simulations to extract the information that is necessary to study the system directly on the level of trait distributions. We illustrate this approach by two examples from game theory. First, we show that it reproduces well-known results on the continuous snowdrift game, while numerical performance is increased by a factor of 1000. Then we consider a network snowdrift game, in which players can cut links to uncooperative neighbors. Here both the cooperative investment and the threshold for cutting links are treated as evolutionary traits. Our results show that this form of topological punishment can effectively enforce cooperation.

AGSOE 9.3 Tue 15:00 BAR 205

**Fixation times in evolutionary games under weak selection** — •Philipp M. Altrock and Arne Traulsen — Max-Planck-Institut für Evolutionsbiologie, Plön, Deutschland

In evolutionary game dynamics, reproductive success increases with the performance in an evolutionary game. If strategy $A$ performs better than strategy $B$, strategy $A$ will spread in the population. Under stochastic dynamics, a single mutant will sooner or later take over the entire population or go extinct. We analyze the mean exit times (or average fixation times) associated with this process [1].

We show analytically that these times depend on the payoff matrix of the game in an amazingly simple way under weak selection [2]: The payoff difference $\Delta\pi$ is a linear function of the number of $A$ individuals $i$, $\Delta\pi = u\,i + v$. The unconditional mean exit time depends only on the constant term $v$. Given that a single $A$ mutant takes over the population, the corresponding conditional mean exit time depends only on the density dependent term $u$. We demonstrate this finding for two commonly applied microscopic evolutionary processes.

[1] T. Antal and I. Scheuring. Fixation of strategies for an evolutionary game in finite populations. *Bull. Math. Biol.*, 36(12):1923–1944 2006.

[2] P. M. Altrock. and A. Traulsen. Fixation times in evolutionary games under weak selection. *New J. Physics*, in press 2008.

AGSOE 9.4 Tue 15:30 BAR 205

**Simulation of the spread of highly allergenic ragweed in past and future** — •Gero Vogl[1], Michael Leitner[1], Manfred Smolik[1], Lorenz-Mathias Stadler[1], Stefan Dullinger[2], Franz Essl[3], Ingrid Kleinbauer[4], and Johannes Peterseil[3] — [1]Fakultät für Physik der Universität Wien — [2]Fakultät für Lebenswissenschaften der Universität Wien — [3]Umweltbundesamt, Wien — [4]VINCA, Vienna Institute for Nature Conservation and Analyses

Modelling the spread of newcomers has traditionally been based on reaction-diffusion equations (Skellam 1951). However, these equations do not allow for explicit considering details of the environment (the habitat). Even by incorporating environmental heterogeneity by adjusting the model parameters to the habitat suitability (e.g. Kinezaki et al. 2002, 2006) the specific spatial habitat configurations cannot be incorporated in detail. Spatially explicit modelling approaches are necessary for describing and predicting the spread of invasive species in real landscapes and as a function of changing climate.

In order to reconstruct by help of Monte Carlo simulations the recent spread of the highly allergenic invasive ragweed (Ambrosia artemisiifolia L.) across Austria we integrate habitat-based information on potential distributions and spatio-temporal range dynamics into a common framework. The result: invasion is not as fast as changing climate would permit, because spread is limited by the constraints of either short range diffusion or long range transport.