SOE 6: Poster

Posters can and should be on display during the whole day.

Time: Monday 17:00–20:00 Location: P2-OG4

SOE 6.1 Mon 17:00 P2-OG4

Where Has All the Surplus Gone? — •Stephen I. Ternyik and Stephen I. Ternyik — POB.201 D-82043Munich

The surplus value of tech-know-logical innovation has disappeared into the few pockets of rentier groups.The monetary flow of the conjunctural motion and energy-driven economic circuit was directed to the holders of natural resources and real estate, i.e. the return from economic rent-seeking became quantitatively greater than productive growth (r>g). Thus, the real socio-economic divide is between the return from rent and the combined return from labor & capital; the passive return from rent outperformed the active return from labor and capital. Unearned income has absorbed earned income (predator-prey-mechanism), causing the energetic momentum of global economic crisis. This is not only a Sisyphean problem of human economic history ; the point of economic singularity can in the nearer future only be achieved, if we will be able to calm down great economic fluctuations that cause unbearable pains for the majority of the human population. Recapturing the invested energy input via taxing economic rent is the simplest method to restore the economic balance of societal production.

SOE 6.2 Mon 17:00 P2-OG4

Phase Transitions in Autonomous Intersection Traffic? — •Dimitra Maoutsa, Debsankha Manik, Malte Schröder, and Marc Timme — Network Dynamics, Max Planck Institute for Dynamics and Self-Organisation

With the advent of self-driving (autonomous) vehicles, street traffic coordinated by traffic lights might soon not only be outdated, but also remarkably inefficient. Improved reactivity and precision of autonomous vehicles (compared to human drivers) opens up the possibility to more effectively coordinate conflicting traffic flows at intersections. Here we study the collective dynamics of intersection traffic managed by vehicle to infrastructure (V2I) communication [1] in combination with slot-based scheduling strategies that induce the formation of vehicle platoons [2]. We reveal under which conditions and how such a system undergoes a transition from free to congested flow and quantify the economic efficiency in dependence of control parameters. A shift from bounded to diverging traffic delays indicate the onset of efficiency losses. Such theoretical insights may help proposing optimized operating points for given traffic conditions and may therefore aid designing the prospective transit from conventionally to autonomously controlled traffic management.

References:

[1] Dresner & Stone, A multiagent approach to autonomous intersection management. J. Artif. Intell. Res. 31:591 (2008).

[2] Remi et al., Revisiting street intersections using slot-based systems, PLoS ONE, 11:e0149607 (2016).

SOE 6.3 Mon 17:00 P2-OG4

How long does it take to board an airplane? — •Reinhard Mahnke[1], Jevgenijs Kaupuzs[2], Eitan Bachmat[3], and Vidar Frette[4] — [1]Rostock University, Institute of Physics, D-18051 Rostock, Germany — [2]Riga Technical University, LV–1048 Riga, Latvia — [3]Ben–Gurion University, Beer-Sheva 84105, Israel — [4]Stord/Haugesund College, N–5528 Haugesund, Norway

A simple airplane-boarding model, introduced earlier by Frette and Hemmer, is considered. In this model, N passengers have reserved seats, but enter the airplane in arbitrary order.

We are looking for an analytical expression, which describes the mean boarding time depending on the total number of passengers N. For this purpose, we first determine precise values of the exponents and expansion coefficients in the asymptotic expression at $N \to \infty$. It is reached by mathematical calculations and fitting the Monte Carlo simulation data for very large N, up to $N \sim 6 \cdot 10^8$.

Finally, we compare the obtained analytical approximation to the simulation data for a realistic number of passengers $N \lesssim 500$ and find a good agreement.

SOE 6.4 Mon 17:00 P2-OG4

Emergent features of triadic relations in political networks — •Andres M. Belaza[1,2], Kevin Hoefman[2], Jan Ryckebusch[1], and Koen Schoors[2] — [1]Department of Physics and Astronomy, Ghent University — [2]Department of General Economics, Ghent University

We propose a model with five energy levels that encodes the dynamics of triadic relationships in a political network. The model builds on insights gleaned from structural balance theory to which we add elements from Boltzmann-Gibbs statistical physics. We go beyond the restrictions of signed networks and introduce the concept of social temperature to encode exogenous effects. We start from the idea that two agents that maintain ties in a political network can be either enemies, or friends, or neutrals to each other. The generic Hamiltonian associated with the five energy levels contains three parameters. One is connected with a three-body interaction inspired on social balance theory. The other two parameters take into account the costs of symmetry breaking and of changing a link. We stress the role of the degeneracy of the different energy levels and how it affects the degree of frustration in the political network. The validity of our model is tested on an extended data set for the time series of triadic relationships for the standings between alliances in a massive multiplayer online role-playing game. We also analyze real-world data for the different factions that play a role in the current war in Syria. We find emerging properties in the triadic relationships between the nodes in a political network, for example reflecting itself in a persistent hierarchy between the different energy levels.

SOE 6.5 Mon 17:00 P2-OG4

Centrality Measures on a Temporal Fashion Network — •Jonas Braun[1], Frederik Wolf[2], Philipp Gert Josef Lorenz[2], Philipp Hövel[2], Colin Bauer[3], Julien Siebert[3], and Vitaly Belik[4] — [1]Department of Physics, Humboldt-Universität zu Berlin, Newtonstraße 15, 12489 Berlin — [2]Technische Universität Berlin — [3]Zalando SE — [4]Freie Universität Berlin

The dissemination of information in social networks is a process, in which some nodes in the network have a much more significant influence on the extent and speed of the spreading than others. Finding these highly influential spreaders has a great significance in understanding and controlling real world networks, suppressing or amplifying the spreading of information.

We analyse the real-world digital platform lookbook.nu, a social network for fashion bloggers. Using simulations on the observed topology as well as measuring real spreading of information, we evaluate centrality measures as an indicator for the power of spreaders on this particular social network.

Due to the dynamic nature of fashion trends, we find that topological changes of the network may occur on the same timescale as the spreading processes. Thus, we investigate whether established centrality measures apply in the context of such a temporal network.

SOE 6.6 Mon 17:00 P2-OG4

Large deviation properties of the Nagel-Schreckenberg model — •Wiebke Staffeldt and Alexander K. Hartmann — Institute of Physics, University of Oldenburg

The probability density function (pdf) $P(q)$ of traffic flow q in the Nagel-Schreckenberg model for one lane traffic [1] for different densities of cars ρ is studied. We apply recently introduced large deviation techniques [2, 3], that work with an artificial temperature to direct the system in different regions. After suitably rescaling the data we obtain the true distribution even in the tails with probabilities as low as 10^{-150} in order to investigate their differences in the low- and high density regime. Numerical simulations for several vehicle densities ρ are performed for two scenarios: the situation of equilibrium on a lane with periodic boundary conditions and a nonequilibirium situation such as all vehicles start at a traffic light. We analyse the shape of the distribution as a function of the density ρ. Furthermore, the influence of finite-size effects is analysed by comparing the results for different system sizes. In particular, we evaluate the rate function $\Phi(q) = -\frac{1}{L}\ln(P(q))$.

[1] K. Nagel and M. Schreckenberg, J. Phys. I 2, 2221 (1992)

[2] A. K. Hartmann, Phys. Rev. E **89**, 051203 (2014)

[3] A. K. Hartmann, Eur. Phys. J. B **84**, 627-634 (2011)

SOE 6.7 Mon 17:00 P2-OG4

Multiple games in the multiverse — •Vandana Revathi Venkateswaran and Chaitanya S. Gokhale — Research Group for Theoretical Models in Eco-Evolutionary dynamics, Department of Evolutionary Theory, Max Planck Institute for Evolutionary Biology, Plön

Evolutionary game theory has proved useful in analyzing interactions between agents in an evolutionary context. For a particular application, usually a single game is analyzed, which can have n strategies. A combination of two, two player two strategy (2x2) games was intensively studied to introduce the idea of Multi Game Dynamics (MGD) and later we studied various combinations of single multi-strategy games.

The results show that it is not always possible to decompose MGD into its constituent games if any constituent game has $n > 2$ and thus impossible to always predict dynamics of a combination of games even if the underlying games are well understood. Even if a game has a fixed-point as an ESS, when it is combined with other games, the combined MGD need not converge to that ESS.

Different initial conditions can lead to different dynamical outcomes. We provide a quantitative extension by analyzing the proportion of initial states deviating from the expected solution. Furthermore the idea of a combination of multiplayer evolutionary games is proposed where the conditions of $n > 2$ is no longer necessary.

SOE 6.8 Mon 17:00 P2-OG4

Lane Change Prediction in an Urban Area — •Karoline Griesbach[1] and Karl Heinz Hoffmann[2] — [1]Institute of Physics, Technische Universität Chemnitz, 09107 Chemnitz, Germany, Telephone: +49 371 531 35456 — [2]Institute of Physics, Technische Universität Chemnitz, 09107 Chemnitz, Germany, Telephone: +49 371 531 35456

The prediction of the lane change and its integration in advanced driving assistance systems can reduce traffic accidents. In the article a neural network for lane change prediction will be discussed. The neural network was implemented with three learning rules: delta rule, backpropagation and backpropagation with momentum. The prediction of right and left lane changes were considered. The input data was provided by a Naturalistic Driving study and divided into a training set and a validation set. The best prediction was achieved for the left lane change with a neural network with backpropagation (tpr = 72.09%, fpr = 0.00%). The prediction of the right lane change was not successful.

SOE 6.9 Mon 17:00 P2-OG4

Emergence of Social Badges — •Gorm Gruner Jensen and Stefan Bornholdt — Universität Bremen, Bremen, Deutschland

Social badges, easily detectable physical traits that strongly correlate with social status, are found in a wide variety of biological species. It is usually assumed that such badges signal an intrinsic strength, warning potential competitors to stay away and attracting potential mates. Under this assumption it is generally understood, that the correlation between badge and intrinsic strength must be strong in order for the receiver to benefit from reacting to it, and the badge must come at a cost in order to avoid false replicas.

We will present a different view, by introducing a minimalistic model in which the badge precedes any intrinsic property. The correlation between badge and social status emerges as a self-organized property due to the collective behavior of individual agents whose strength is affected by their self esteem, and whose self esteem is faithfully inferred from previous experience.

SOE 6.10 Mon 17:00 P2-OG4

Motif formation in the Japanese Business Firm Network — •Julian Maluck[1,2], Reik V. Donner[1], Hideki Takayasu[2], and Misako Takayasu[2] — [1]Potsdam Institute for Climate Impact Research, Germany — [2]Tokyo Institute of Technology, Japan

We investigate how characteristic patterns in the establishment of business relationships and merging agreements between firms explain the functional roles and organization of 3-party interactions in the Japanese Business Firm Network. By considering industry dependent linking patterns of newly established firms in an evolving network model, the conceptual understanding of the emergence of motifs at the meso-scale of the network can be improved. At the global scale, however, an observed overshoot of appearances of densely connected motifs in the model requires additional explanation in terms of merging preferences between firms. We provide evidence towards the tendency of Japanese business firms to merge with other firms that show similar patterns in their input/output allocations.

SOE 6.11 Mon 17:00 P2-OG4

Impacts of Regional Trade Agreements on the flow of goods and money in the world economy — Julian Maluck and •Reik V. Donner — Potsdam Institute for Climate Impact Research, Germany

Free trade agreements have received rising attention within the last decades, with trade deals having been negotiated at an increasing pace. Multi-regional input-output (MRIO) tables allow for a concise analysis of trade relations between industries both at a national and international level. By evaluating an industry's dependency on its consuming and supplying industries from MRIO data, we construct two flow networks of goods and money, respectively. We present how flow networks can be utilized to quantify impacts of various Regional Trade Agreements by methods from complex network theory. Next to a comprehensive overview of these impacts, our results provide the basis for further detailed studies on the implications of specific design patterns within trade agreements.

SOE 6.12 Mon 17:00 P2-OG4

Opinion formation on networks: the topology may predict more than we think. — •Michael Schnabel and Daniel Diermeier — University of Chicago, Chicago, USA

We consider opinion formation on a given network, using interacting spin systems on arbitrary network topologies as a modeling framework, and propose to project the high dimensional state space of possible opinion configurations onto two dimensions that quantify the average opinion as well as the average local consensus in the network. For an Ising model these macroscopic order parameters would correspond to the magnetization M and the energy E. Our approach, however, is not restricted to the Ising model. This two dimensional representation allows to obtain model independent insight into predominant opinion configurations that are imposed by the network topology alone. We devise a numerical method, based on the Wang-Landau algorithm, to determine the density of states for arbitrary network topologies which essentially sets the stage on which the flow of opinions can unfold once a particular dynamical model has been specified. Our framework may be used to draw general conclusions about the typical distribution of opinions in small to medium sized networks (up to O(10^3) nodes), e.g. such as identifying network topologies that would facilitate (or prevent) the occurrence of consensus or fragmentation of opinions in the network, and may be applicable for a broad range of dynamical models.

SOE 6.13 Mon 17:00 P2-OG4

Heider balance in bilayer networks — •Piotr J Górski[1], Krzysztof Kułakowski[2], Przemysław Gawroński[2], and Janusz A Hołyst[1] — [1]Faculty of Physics, Warsaw University of Technology, ul. Koszykowa 75, 00-662 Warsaw, Poland — [2]AGH University of Science and Technology, Faculty of Physics and Applied Computer Science, al. Mickiewicza 30, 30-059 Kraków, Poland

In a social network links may describe friendly or hostile interpersonal relations. According to Heider balance theory these relations change in order to obtain a system of balanced link triads. A triad is balanced when four axioms are fulfilled; one of which is "a friend of my enemy is my enemy". Here, we analyze the formation of the Heider balance in a bilayer network governed by link dynamics. Each link evolves being influenced by its neighbor links from the same layer and its replica from the other layer. The relative strength of coupling between layers is modeled using a pair of coupling coefficients (β_1, β_2). We investigate systems with asymmetric layer coupling, i.e. $\beta_1 \neq \beta_2$. We discover tendencies driving system dynamics. We observe many phenomena, such as transitions between the ordered and unordered states (in terms of above mentioned tendencies), nonlinear oscillations of relations, and "master-slave effect" of layer dependence. The obtained results comprise rich diagrams of model parameters that allow us to identify the areas of coupling coefficients leading to high probability of attaining Heider balance.

SOE 6.14 Mon 17:00 P2-OG4

A behavioral spruce budworm predation model — Bhagyashree Hote[1], Manas Joshi[1], Reeve Ahmed[1], Maleeha Aziz[1], and •Jens Christian Claussen[1,2] — [1]Computational Life Science Program, Jacobs University Bremen — [2]Computational Systems Biology, Jacobs University Bremen

The spruce budworm model has become a classical model of predation of spruce budworms by birds [1]. In this model, the sublinear onset of predation is motivated by a metaphor that birds predate the spruce budworms only if this food source reaches awareness among the predators. Here, we explicitely introduce the fraction of birds that are aware of the additional food source as an additional dynamical variable and formulate a plausible dynamics for its increase and decay. For suitable parameters, the model shows an attracting spiral node, which results in damped oscillations of the prey density towards the fixed points.

[1] Murray, Mathematical Biology (Springer, 2002).

SOE 6.15 Mon 17:00 P2-OG4

Size distribution of scientific paradigms in the Bornholdt-Jensen-Sneppen model on complex networks — Kim Philipp Jablonski[1] and •Jens Christian Claussen[1,2] — [1]Computational Life Science Program, Jacobs University Bremen — [2]Computational Systems Biology, Jacobs University Bremen

The Bornholdt-Jensen-Sneppen model [1] describes the emergence and decay of scientific paradigms by a stochastic dynamics of imitation of neighboring strategies, based on their overall abundance, in competition with a second mutational process introducing a new paradigm. This model has been shown to exhibit a powerlaw 2.5 statistics of the overall number of sites that have been touched by a paradigm. Here, we investigate the corresponding generalizations of this dynamics on complex networks. Our simulations indicate that, apart from minor deviations, the shape of the statistics remains preserved on different network topologies.

[1] S. Bornholdt, M.H. Jensen, K. Sneppen, Phys. Rev. Lett 106, 058701 (2011)

SOE 6.16 Mon 17:00 P2-OG4

Global Urban Energy Efficiency: Insights from scaling laws — •Ramana Gudipudi[1], Mathias K. B. Lüdeke[1], and Jürgen P. Kropp[1,2] — [1]Potsdam Institute for Climate Impact Research, Potsdam, 14412, Germany — [2]Department of Geo- and Environmental Sciences, University of Potsdam, Potsdam, 14476, Germany

The scaling properties of total urban energy use with city size were investigated based on a sample of 223 cities worldwide in developing and developed countries for the first time. We found sub-linear scaling of energy with population (slope = 0.88) but the quality of the fit appears to be relatively low (R^2 = 0.83) for the logarithmic variables. This can be significantly improved (R^2=0.9) by dividing the cities sample into two subsets separated by their degree of industrialization. Furthermore, it appears that – independent from the chosen industrialization threshold – the more service oriented cities scale almost linearly with size because of their infrastructure lock-in behavior while the industrialized cities with nascent infrastructure show a significantly lower exponent. According to this analysis, the energy consumption of larger industrialized cities is typically more energy efficient per cap than that of smaller cities which is good news given the strong global urbanization trend. The results also underscore the energy consumption traits of richer service oriented cities where size does not influence the energy consumption.

SOE 6.17 Mon 17:00 P2-OG4

Local or global, the request for a sustainable urban food system — •Steffen Kriewald, Prajal Pradhan, and Jürgen P. Kropp — Potsdam Institute for Climate Impact Research, Potsdam, Germany

The share of urban population has increased from 30% to 55% in the last sixty years and will further increase up to 65% by 2050. Hence, it is crucial to provide enough food for the growing urban population to ensure local, regional and global food security. For over 4000 urban agglomerations we investigated the possibility of regional food production to reduce dependency on global trade. Additionally we examined the main influencing factors which lead to a sustainable food supply, such as population growth, urban sprawl, diets - both in terms of quantity and composition as well as climate change. Introducing a spatially explicit urban footprint from food production we were able to identify regions where future expansion of agricultural areas is limited and intensification will no longer be an option due to the impacts of climate change.

SOE 6.18 Mon 17:00 P2-OG4

Optimization of urban food networks and its climate benefits — •Prajal Pradhan[1], Steffen Kriewald[1], Luis Costa[1], and Jürgen Kropp[1,2] — [1]Potsdam Institute for Climate Impact Research (PIK), Potsdam, Germany — [2]University of Potsdam, Potsdam, Germany

By 2050, urban population share grow to 65%. Therefore, feeding the growing urban population is crucial to ensure local, regional and global food security. However, food is mostly grown in nonurban regions. This reflects interdependency of hinterlands and urban areas in food production and consumption, which can be considered as urban foodshed.

We analyze urban foodshed for 7000 urban administrative units (UAUs) across the globe and estimate greenhouse gas emissions related to food transport applying two different methods: i) globalized agricultural trade where food is brought from an arbitrary site, ii) an optimization scenario where food demands are met by UAUs' peripheral regions. We also account for reduction of food waste and closing of crop yield gaps to understand their impacts on both globalization and optimization scenarios.

Our results show that mean distance, total distance, net food transport, net food transport distance and associated greenhouse gas emissions are lower for most UAUs in the optimization scenario compared to the globalization scenario. Our analyses on food waste reduction and yield gaps closing also result in lower estimates. Hence, our study provides new insights on required measures to decrease urban foodshed and to reduce emissions related to food transport.