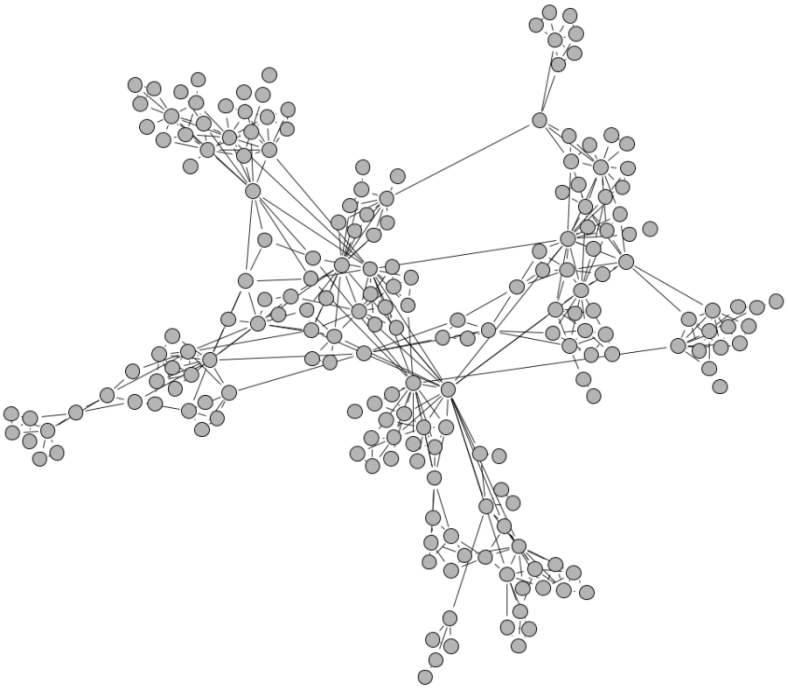
Experiments and Models of Social Networks:

Cooperation, Conflict and Trust

Interdisciplinary Symposium 12-13 May 2016

Videnskabernes Selskab, H.C. Andersens Boulevard 35, 3. sal, 1535 København V, Denmark.



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Thursday 12th May

1st theme: Evolutionary and hierarchical aspects of Conflict and Cooperation

09.00 – 09.15 Introduction by organizers

09.15 – 10.00 **Elizabeth Hobson**, University of Tennessee, USA

10.00 – 10.45 **Christina Pawlowitsch**, Université de Paris 2, France

10.45 – 11.15 Coffee

11.15 – 12.00 **Arne Traulsen,** Max Planck Institute, Plön, Germany

12.00-13.30 Lunch

2nd theme: Interactions and Structural issues of Cooperation, Conflict and Trust

13.30 -14.15 **Stefan Bornholdt**, University of Bremen, Germany

14.15 – 15.00 **Karolina Safarzynska**, University of Warsaw, Poland

15.00 – 15.30 Coffee

15.30 -16.15 **Simon Dedeo**, Santa Fe Institute / Indiana University Bloomington, USA

16.15 – 17.00 Open discussion

Friday 13th May

3rd theme: Networks interactions

09.15 – 10.00 **Milena Tsvetkova**, Oxford Internet Institute, UK

10.00 – 10.45 **Jorge Pacheco**, University of Minho, Lisboa, Portugal

10.45 – 11.15 Coffee

11.15 – 12.00 **Christian Waldstrøm**, Aarhus University, Denmark

12.00 – 13.30 Lunch

4th theme: Network interactions and Synthesis followed by open discussion

13.30 - 14.15 **Sune Lehmann**, Danish Technical University / Copenhagen University

14.15 - 15.15 Open discussion of implications and future directions and challenges.

Abstracts

1st theme: Evolutionary and hierarchical aspects of Conflict and Cooperation

Social knowledge underlying conflict decisions and assessment of rivals

Elizabeth Hobson, Postdoctoral Fellow, National Institute for Mathematical and Biological Synthesis, University of Tennessee, Knoxville, TN, USA

The complexity of human groups differentiates human sociality from animals but we have a limited understanding of how this extreme sociality evolved. In animals, recent work has focused on the cognitive abilities underlying the emergence of social complexity. Social knowledge allows for feedback processes through which an individual's local observations of group members can be converted to global social knowledge, which can then be used by individuals to inform subsequent local interactions. However, quantifying the extent of an animal's social knowledge of their group members is challenging. Furthermore, we know little about the cost and benefit tradeoffs of using simpler or more cognitively demanding social strategies, or the potential factors that may cause an evolutionary shift between systems. In this talk, I describe how a highly social avian species uses what appears to be a cognitively demanding assessment method, based on individual recognition and third-party observations of group members, to assess rivals and make decisions about who to fight. Social knowledge forms quickly in these novel groups as individuals learn about each other's ranks and they shift to focusing their fighting on near-ranked potential challengers. Using an agent-based model, I compare the learning efficiency and accuracy of a fully individualized rank assessment system versus one based on categorical grouping by perceptible differences, or badges of status. Individualized recognition systems usually result in more accurate assessment of others, but at a cost of requiring a longer learning time than categorical systems. However, as group sizes become large or the length of time animals remember shortens, categorical systems often outperform individualized systems. Modeling predictions can then be compared to empirical data to predict the type of assessment system and to understand the evolutionary transitions between both learning systems.

Invariant extensive-form rationalizability

Christina Pawlowitsch, Université Panthéon-Assas, Paris II, joint with Rida Laraki, CNRS, Paris Dauphine, France

To any game in extensive form (a game given by a tree) one can associate the normal-form representation of that game (a matrix for two-player games). A game in matrix form can stem form many different extensive forms.

In this paper we bring together two ideas: rationalizability in the extensive form (Pearce, 1984) and invariance---the notion that the solution of a game in extensive form should be invariant under any equivalence transformation of that extensive form. We focus on a particular class of equivalence transformations, namely those that leave the associated reduced normal form of the game unchanged (Dalky 1952; Thompson 1952; Kohlberg and Mertens 1986; Elmes and Reny 1996). We first show that rationalizability in the extensive form can be decomposed into an iterative process that operates on families of truncations of the associated reduced normal form of the game under which a strategy gets deleted whenever it is not a best response in one of the normal-form truncations associated to it. This decomposition allows us to simplify the definition of extensive-form rationalizability and to establish some properties of the process that so far have not been stated. We then demonstrate that the set of extensive-form rationalizable strategy profiles is invariant under the following two transformation of the extensive form: interchange of simultaneous moves and coalescing of moves; but that it is not invariant under addition of a superfluous move; in general, adding a superfluous move enlarges the set of extensive-form rationalizable strategies. Yet, rationalizability in the extensive form and the axiomatic requirement that the solution of a game be invariant under any extensive form that has the same reduced normal form do not exclude each other: we show that for a given reduced normal form, there exists a set of strategy profiles that is contained in the set of extensive-form rationalizable strategy profiles of any extensive form that has that same reduced normal form---the invariant extensive-form rationalizable set. We illustrate our results in the context of some examples that are important reference points in the discussion of solution concepts for extensive-form games ("The Battle of the Sexes preceded by an outside-option for one other the players; "Burning Money"; and the "Beer-Quiche" game).

Modelling cooperation and punishment in public goods games

Arne Traulsen, Max Planck Institute, Plön, Germany

Cooperation can be enforced by peer-punishment. While it has argued that punishment itself is a public goods problem, being known as somebody who is a responsible punisher can be valuable. With such reputation involved, cooperation becomes a winning strategy. Often, models are restricted in the sense that only cooperators can punish. Extending the strategy sets to all possible strategies shows that known results in restricted models are robust and punishment can prevail in the face of second order free-riders, antisocial punishment, and spite. Also in the case of institutional punishment, to establish such an institution can be a costly signal that induces cooperation. Even here, going beyond the usual assumption that only institutions that punish defectors exist shows that previous results are robust: Good, but no evil institutions should emerge.

2nd theme: Interactions and Structural issues of Cooperation, Conflict and Trust

Title

Stefan Bornholdt, University of Bremen, Germany

Between-group conflict and cooperation in the common-pool resource experiment

Karolina Safarzynska, University of Warsaw, Poland

How does uncertainty over resources affect harvesting? Under which conditions would individuals share resources with out-group members? Does resource uncertainty escalate conflicts over resources? So far, we know surprisingly little about how intergroup conflict and cooperation over resources affect in-group harvesting and the probability of resource exhaustion. However, there are concerns that climate change will escalate the scarcity of renewable resources, and contribute to resource conflicts in the future. In this paper, we present experimental evidence on how harvesting from the common-pool of resources is affected by (1) resource uncertainty, (2) intergroup resource sharing, (3) intergroup conflict, and their interactions. In the experiment, climate change takes the form of droughts that occasionally destroy a fraction of the resource. The theoretical predictions are that shocks destroying resources encourage resource conservation, while sharing resources between groups promotes overharvesting. The results from our experiment confirm these predictions. In addition, we find that groups often share resources with out-group members, but only if their behavior is reciprocated by another group. Finally, we find that intergroup conflicts are frequent. This comes as a surprise because on average groups have nothing to gain from conflict in our experimental design.

Title

Simon Dedeo, Santa Fe Institute / Indiana University Bloomington, USA

3rd theme: Networks interactions

The Dynamics of Disagreement

Milena Tsvetkova, Oxford Internet Institute, UK

Disagreement and conflict are a fact of social life. However, negative interactions are rarely explicitly declared and recorded and this makes them hard for scientists to study. We overcome this challenge by using complex network methods to investigate the patterns in the timing and configuration of contributions to a large online collaboration community. We analyze sequences of reverts of article edits to Wikipedia, the largest online encyclopedia, and investigate how often and how fast they occur compared to a null model that randomizes the order of actions to remove any systematic clustering. We find evidence that Wikipedia editors systematically attack the same person, attack back their attacker, and come to defend an attack victim. We further find that high-status editors are more likely to attack many others serially, status equals are more likely to revenge attacks back, while attacks by lower-status editors trigger attacks forward; yet, it is the lower-status editors who also come forward to defend third parties. Our results reveal that certain social dynamics that have not been previously explored underlie the knowledge collection practice conducted on Wikipedia. Our method can be applied to other large-scale temporal communication and collaboration networks to identify the existence of negative social interactions and other social processes.

Linking Individual and Collective Behavior in Adaptive Social Networks

Jorge Pacheco (*,#)**, Departamento de Matemática e Aplicações, Universidade do Minho, Portugal**

A central and transversal problem in Science is to understand how collective behavior results from given individual interactions. In particular, to understand the link between individual social behavior and emergent collective phenomena (vaccination, epidemics, crowd behavior, diffusion of innovations, etc). Here I address this problem by letting individuals engage in pair-wise interactions by means of a well-defined social dilemma (a prisoner's dilemma of cooperation). These individuals are embedded in a social network that is both complex and adaptive. Adaptation here allows individuals to manifest preferences and resolve conflicts of interest, reshaping the network accordingly. Exact Monte-Carlo simulations reveal the inadequacy of any of the tools developed to date to predict the co-evolutionary dynamics of the population at large. I will present

and discuss in detail an adaptive-network-sensitive observable that is capable of predicting the collective, population-wide dynamics, given prior knowledge of the fundamental rules that govern the social interaction between 2 individuals in a social network. In particular, I will show how adaptive social networks act to change the "collective" game, from a 2-person game into a N-person game exhibiting a radically different co-evolutionary dynamics.

(*) work carried out in collaboration with Francisco C. Santos (@INESC-ID, Lisbon) & Flávio P. Pinheiro (@MIT-MEDIA-LAB)

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Under Pressure: How Job Pressures Influence Workplace Network Dynamics

Christian Waldstrøm, Dept. of Management, Aarhus University, Denmark

Abundant organizational research demonstrates that people's involvement in workplace networks affects their jobs. Remarkably little, however, is known about whether people's jobs affect their network involvement. Job pressures, such as working at a high pace or with high emotional involvement, create deficits of time and energy resources. We theorize that people may modify their network participation to conserve resources, since networks facilitate resource acquisition but also require resource investments. A longitudinal network study of an R&D department within a Scandinavian biotechnology firm confirms that the type and level of employees' job pressures influence their network involvement tendencies and their reciprocity and closure preferences over time, even after accounting for alternative explanations of network change. Our research brings together the perspectives of job demands and social networks, recognizing the work context as a consequential antecedent to network dynamics, and emphasizing the interplay of the formal and informal organizations.

4th theme: Network interactions and Synthesis

The fundamental structures of dynamic social networks

Sune Lehmann, Department of Applied Mathematics and Computer Science, Danish Technical University / Copenhagen University

Social systems are in a constant state of flux with dynamics spanning from minute-by-minute changes to patterns present on the timescale of years. Accurate models of social dynamics are important for understanding spreading of influence or diseases, formation of friendships, and the productivity of teams. While there has been much progress on understanding complex networks over the past decade, little is known about the regularities governing the micro-dynamics of social networks. Here we explore the dynamic social network of a densely-connected population of approximately 1000 individuals and their interactions in the network of real-world person-to-person proximity measured via Bluetooth, as well as their telecommunication networks, online social media contacts, geo-location, and demographic data. These high-resolution data allow us to observe social groups directly, rendering community detection unnecessary. Starting from 5-minute time slices we uncover dynamic social structures expressed on multiple timescales. On the hourly timescale, we find that gatherings are fluid, with members coming and going, but organized via a stable core of individuals. Each core represents a social context. Cores exhibit a pattern of recurring meetings across weeks and months, each with varying degrees of regularity. Taken together, these findings provide a powerful simplification of the social network, where cores represent fundamental structures expressed with strong temporal and spatial regularity. Using this framework, we explore the complex interplay between social and geospatial behavior, documenting how the formation of cores are preceded by coordination behavior in the communication networks, and demonstrating that social behavior can be predicted with high precision.